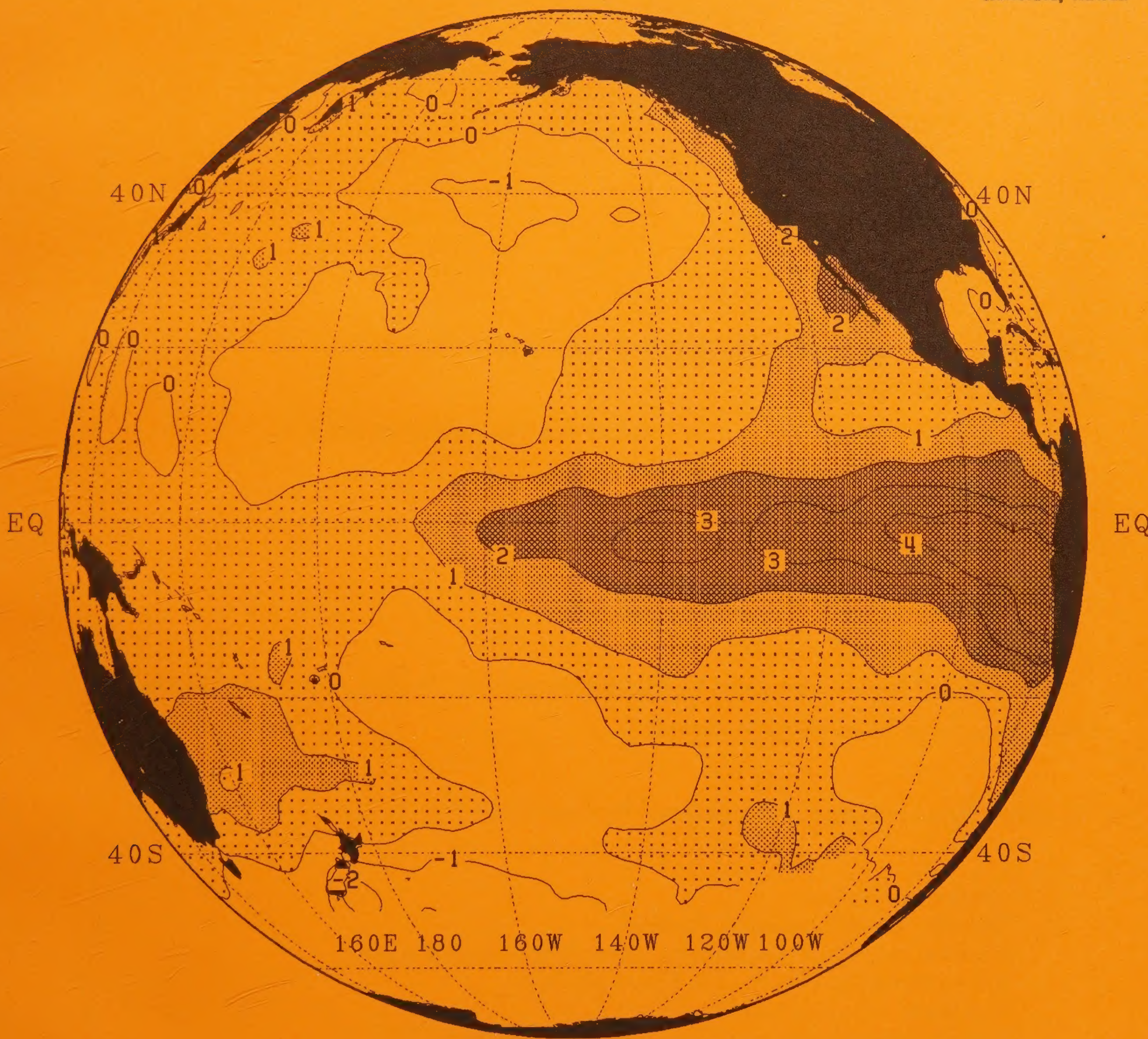
気象庁海洋月報

Monthly Ocean Report

December 1997 (No. 60)



Climate and Marine Department
Japan Meteorological Agency

気象庁 気候・海洋気象部

平成9年12月

気象庁海洋月報は、気象庁 気候･海洋気象部 海洋課で作成されています。

本月報に関する問い合わせは、

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Monthly Ocean Report is prepared by the Oceanographical Division, Climate and Marine Department, Japan Meteorological Agency.

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表紙は、1997年12月の太平洋の月平均海面水温偏差図です。

陰影部は、平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for December 1997 in the Pacific Ocean.

Areas of positive anomalies are shaded.

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海況の特徴（１９９７年１２月）

日本近海の海況

海面水温は，九州近海から南西諸島にかけてと釧路沖で平年より1℃以上高かった（第4図）。

黒潮は，九州から紀伊半島にかけて接岸した後，東に流れ，八丈島付近を経て房総半島沖に達していた。その後，35゜N付近を東進し145゜E付近では33.5゜Nまで南下していた（第9図）。

親潮系の冷水の沿岸寄りの分枝は39.3゜N，142.9゜Eまで達していた（第5図）。

太平洋の海況

太平洋赤道域の海面水温は，165゜W以東で平年より1℃以上高く，110゜W以東では+4℃以上の正偏差が見られた。エルニーニョ監視海域（4゜N～4゜S，150゜W～90゜W）の海面水温の平年偏差は+3.4℃と，依然として大きな値であった（表1）。

北太平洋では，40゜N付近の海面水温の負偏差域は先月より東に移り，170゜Wから150゜Wで-1℃の負偏差であった。北米沿岸の15゜Nから55゜Nでは前月に引続き平年より1℃以上高かった（第16図）。

Highlights December 1997

Seas adjacent to Japan

Positive SST anomalies exceeding +1°C were observed around Kyushu and Nansei Islands, and off Kushiro (Fig. 4).

The Kuroshio flowed along the coast from Kyushu to Kii Peninsula. After passing near Hachijo Island, it flowed eastward off Boso Peninsula along 35°N and turned southward to 33.5°N at 145°E (Fig. 9).

Coastal branch of the Oyashio cold water extended southward to 39.3°N, 142.9°E (Fig. 5).

Pacific Ocean

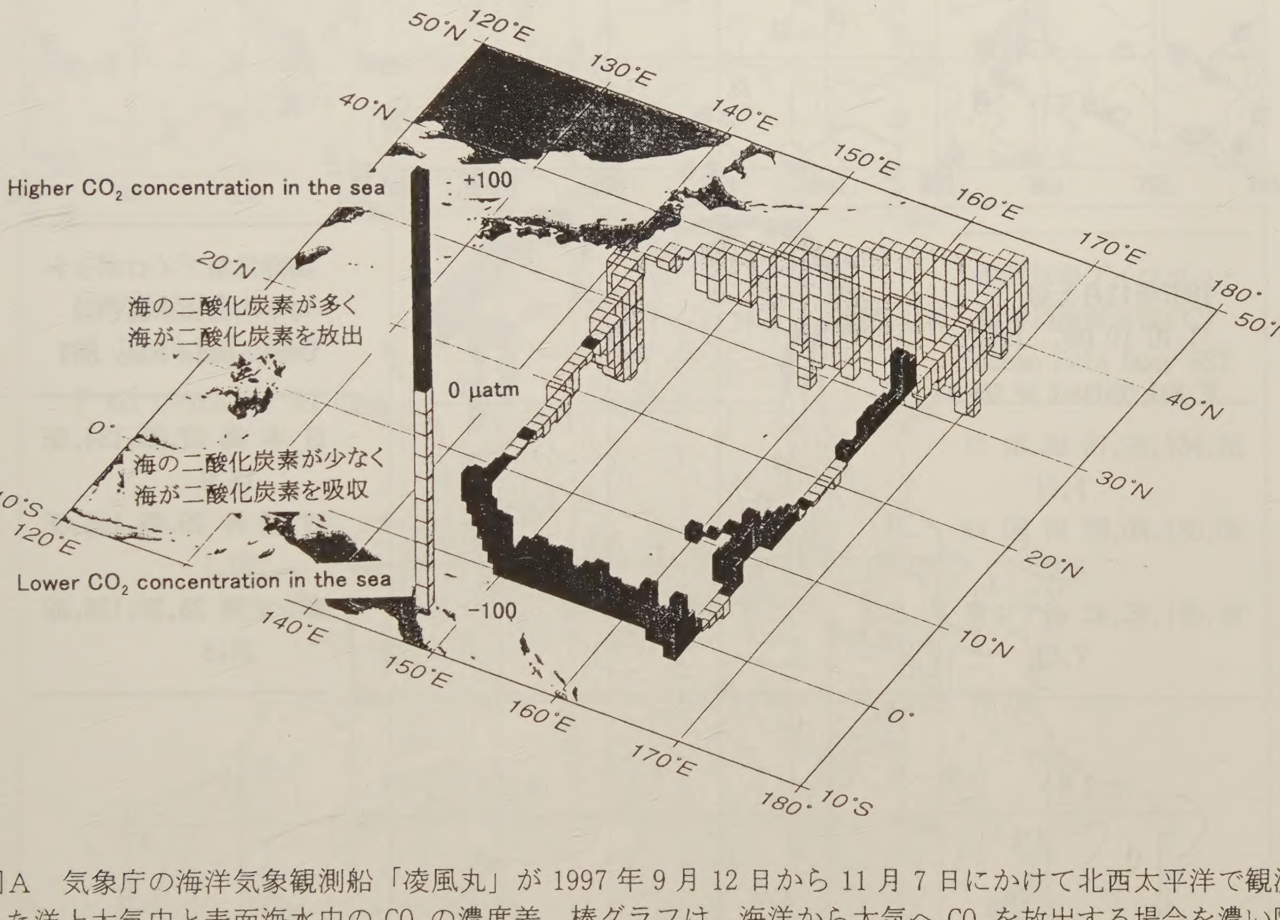
In the equatorial Pacific, SSTs were more than 1°C above normal east of 165°W, and positive SST anomalies exceeding +4°C were found east of 110°W. The SST anomaly of El Niño monitoring region (4°N-4°S, 150°W-90°W) remained extremely large value of +3.4°C (Table 1).

In the North Pacific, an area of negative SST anomalies of -1°C along 40°N was found from 170°W to 150°W in December, shifting eastward from last month. Positive SST anomalies exceeding +1°C were found along the North American coast between 15°N and 55°N (Fig.16).

Observation of carbon dioxide in the western North Pacific

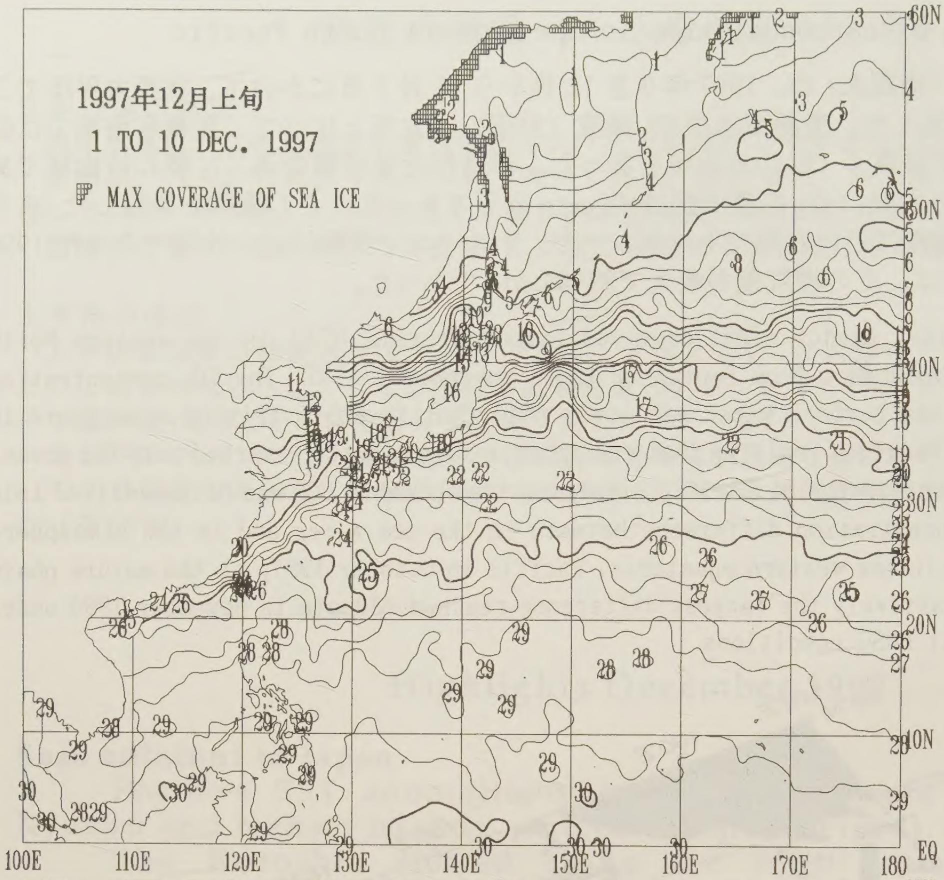
気象庁の海洋気象観測船「凌風丸」は、1997 年 9 月 12 日から 11 月 7 日にかけて、北西太平洋で二酸化炭素（CO_2）の観測を実施した。表面海水中 CO_2 濃度（分圧）は大気と比べて、亜寒帯海域では低く CO_2 の吸収域、赤道付近では高く CO_2 の放出域であった。赤道付近は年間を通じて概ね放出域であるが、今回の観測では海洋と大気の CO_2 の濃度差は+30μatm 以下であった。この観測を実施した 10 月は、エルニーニョ現象の最盛期に近い状態であった。一方、ラニーニャ現象に近い状態であった 1996 年 11 月の赤道付近の観測では、その濃度差が最大で約+80μatm であった。

The Japan Meteorological Agency (JMA) observed carbon dioxide (CO_2) in the western North Pacific on board the R/V *Ryofu Maru* from September 12 to November 7, 1997. The CO_2 concentration (partial pressure) in the sea surface water was lower than that in the overlying atmosphere in the western subarctic North Pacific, implying that atmospheric CO_2 was being absorbed into the ocean, and was higher in the western equatorial Pacific, implying that oceanic CO_2 was being emitted into the atmosphere. The CO_2 concentration difference between in the sea water and in the atmosphere no longer exceeded +30μatm in the western equatorial Pacific in October 1997, at the mature phase of the El Niño event. Contrastively the largest difference reached +80μatm in November 1996 under slightly cooler-than-normal ENSO conditions.

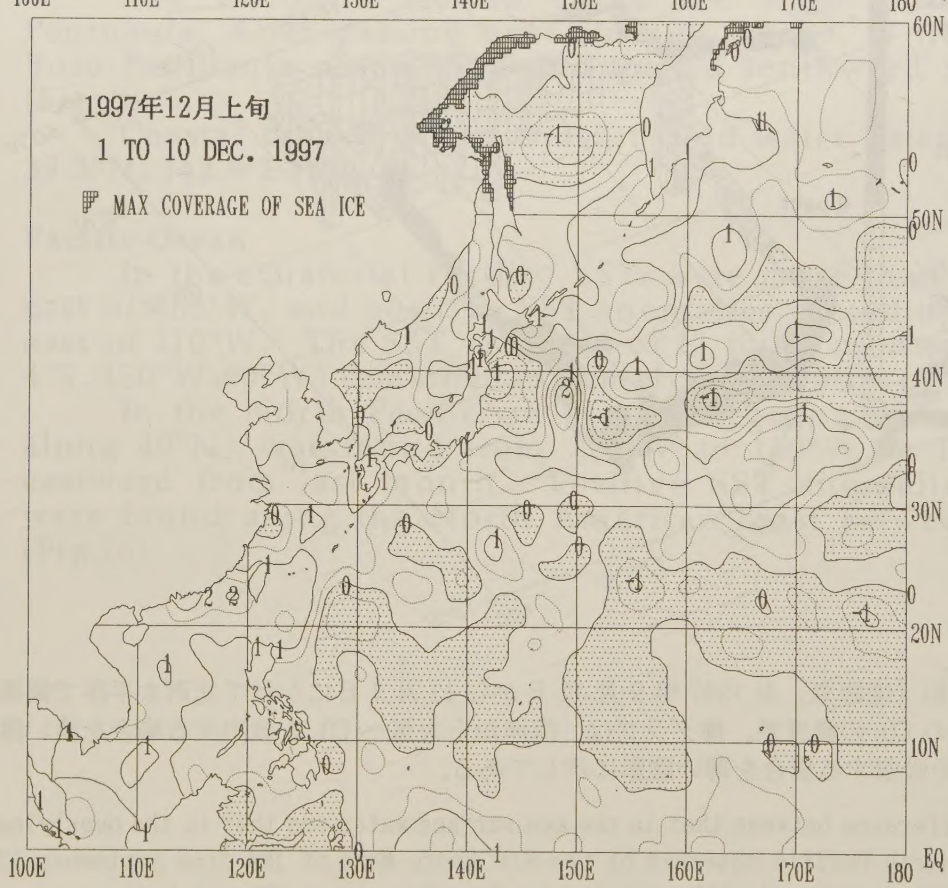


図A　気象庁の海洋気象観測船「凌風丸」が 1997 年 9 月 12 日から 11 月 7 日にかけて北西太平洋で観測した洋上大気中と表面海水中の CO_2 の濃度差。棒グラフは、海洋から大気へ CO_2 を放出する場合を濃い陰影、および海洋が大気の CO_2 を吸収する場合を薄い陰影に示してある。

Fig. A　CO_2 concentration difference between that in the sea surface water and that in the overlying atmosphere in the western North Pacific observed by the R/V *Ryofu Maru* of JMA from September 12 to November 7, 1997. Darker-shaded upward pillars indicate that the oceanic CO_2 was being emitted into the atmosphere, and lighter-shaded downward pillars indicate that the atmospheric CO_2 was being absorbed into the ocean, respectively.



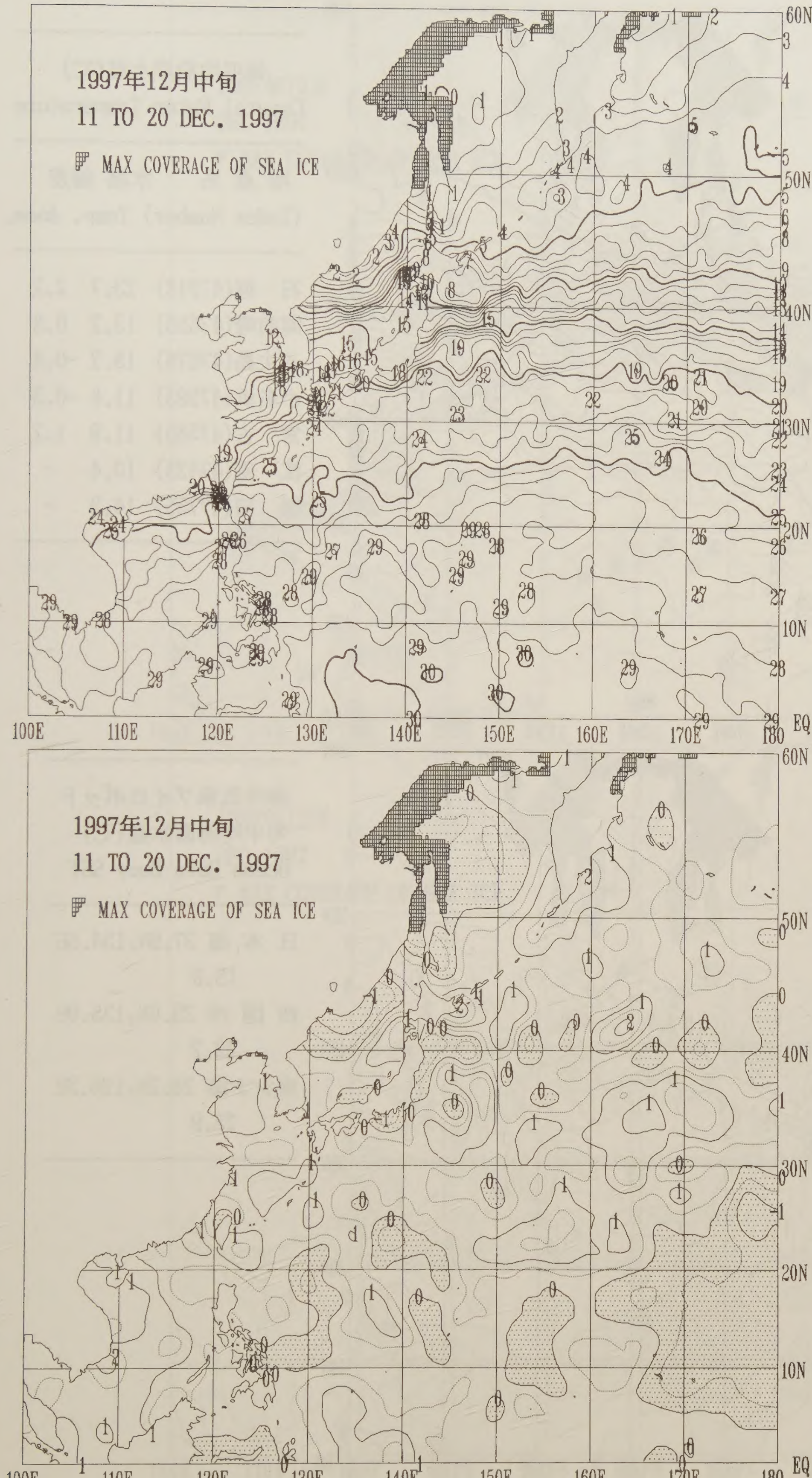
旬平均沿岸水温(℃) Coastal Water Temperature		
地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	24.1	1.7
御前崎(47655)	15.9	1.6
八丈島(47678)	21.1	1.1
小名浜(47598)	14.5	0.7
宮　古(47585)	13.3	0.5
江　差(47428)	10.2	-
浜　田(47755)	15.8	-



海洋気象ブイロボット 旬平均海面水温(℃) Ocean Data Buoy SST	
日本海	37.9N,134.5E 15.9
四国沖	29.0N,135.0E 23.1
東シナ海	28.2N,126.3E 24.8

第1図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年12月上旬)

Fig.1 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 1st ten-day period in DEC 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

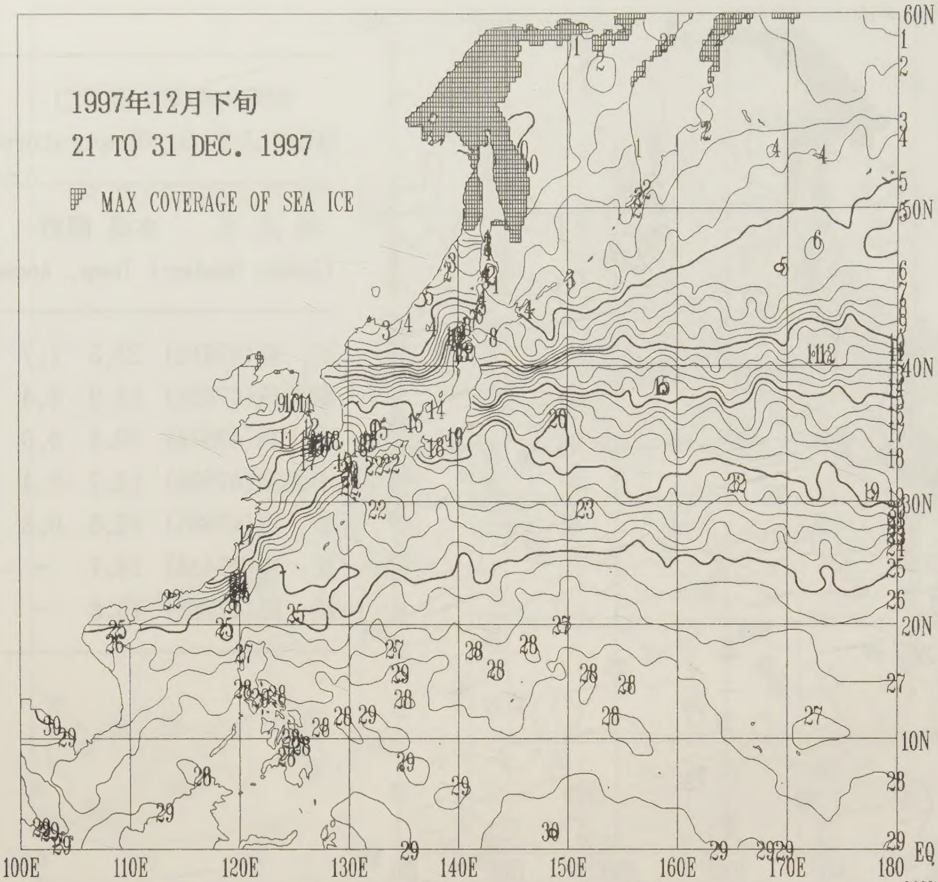
地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	23.5	1.7
御前崎(47655)	13.9	0.4
八丈島(47678)	19.4	0.0
小名浜(47598)	12.7	-0.4
宮　古(47585)	12.5	0.8
江　差(47428)	10.7	-
浜　田(47755)	13.8	-

海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

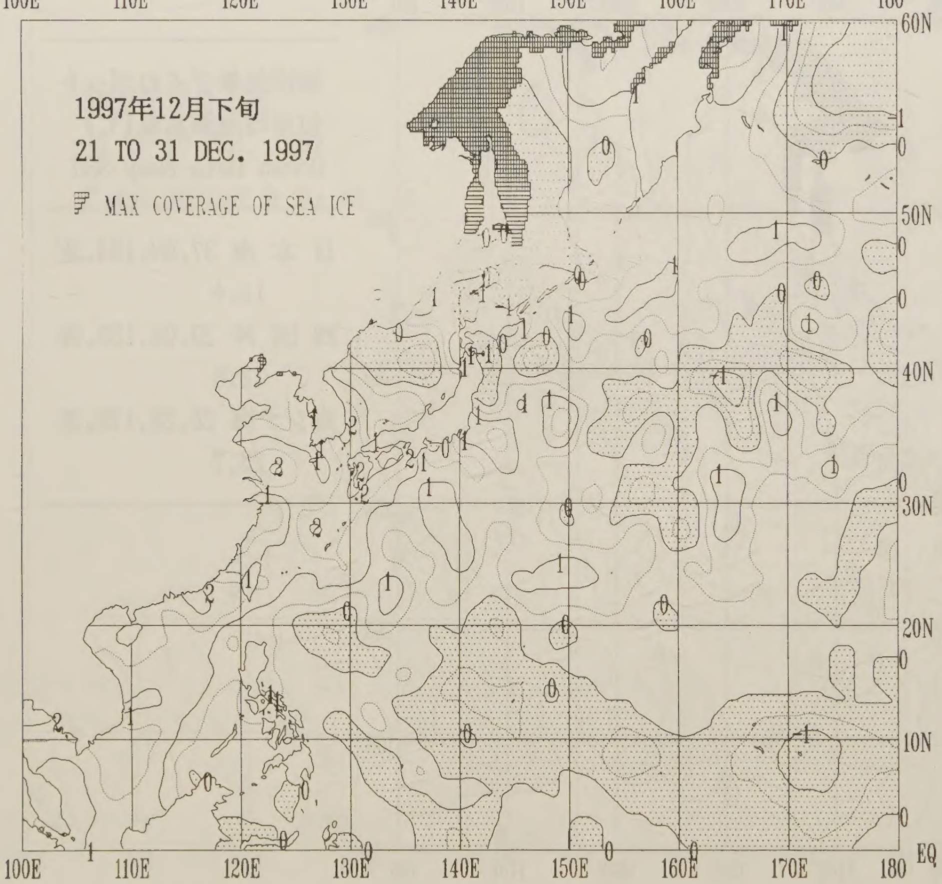
日本海	37.9N,134.5E	15.4
四国沖	29.0N,135.0E	22.6
東シナ海	28.2N,126.3E	23.7

第2図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年12月中旬)

Fig.2 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 2nd ten-day period in DEC 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



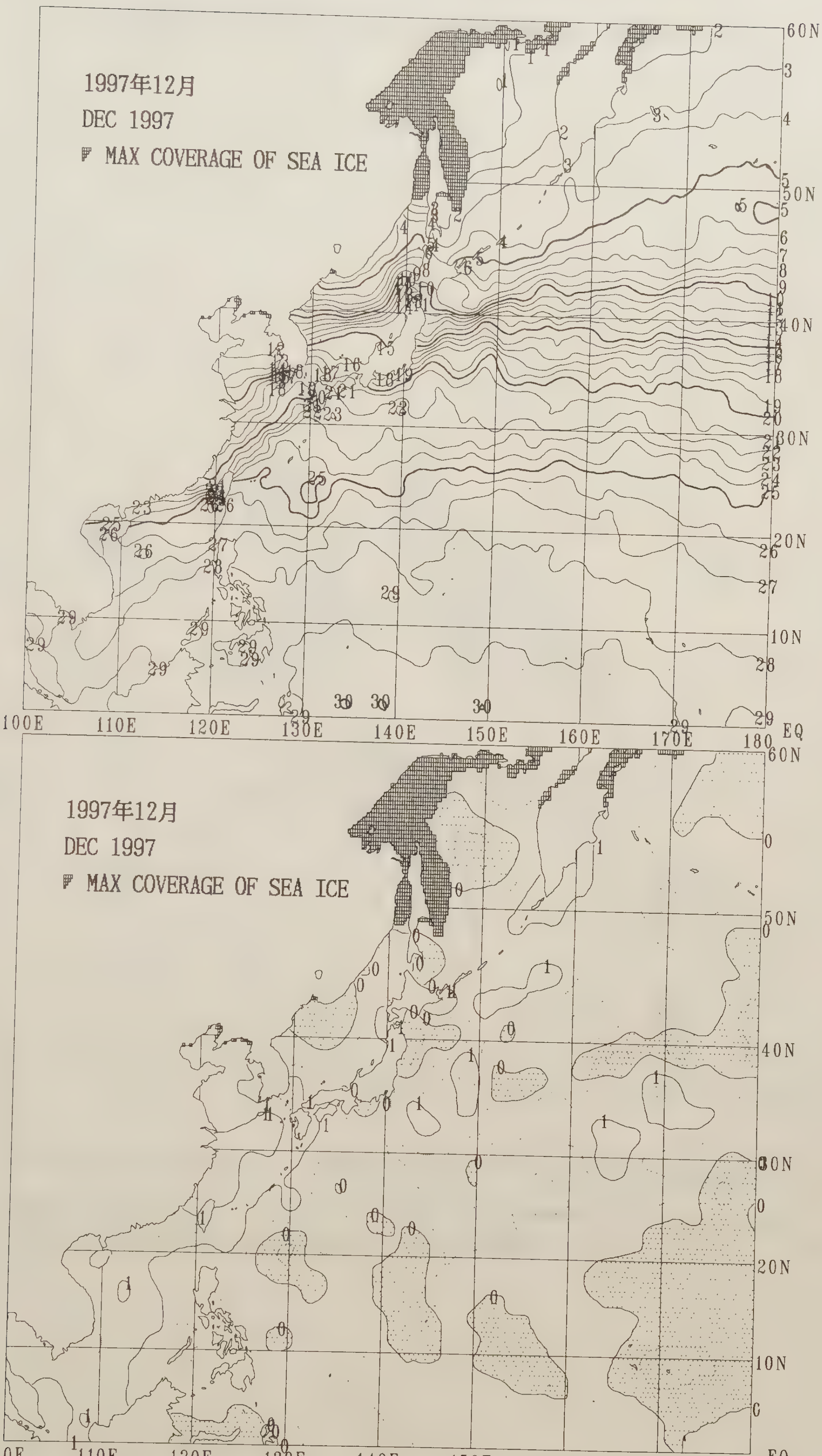
旬平均沿岸水温(℃)		
Coastal Water Temperature		
地 点 名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	23.7	2.2
御前崎(47655)	13.2	0.8
八丈島(47678)	18.2	-0.4
小名浜(47598)	11.8	-0.3
宮　古(47585)	11.9	1.2
江　差(47428)	10.4	-
浜　田(47755)	14.3	-



海洋気象ブイロボット 旬平均海面水温(℃) Ocean Data Buoy SST		
日 本 海	37.9N,134.5E	15.0
四 国 沖	29.0N,135.0E	22.2
東シナ海	28.2N,126.3E	23.9

第3図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年12月下旬)

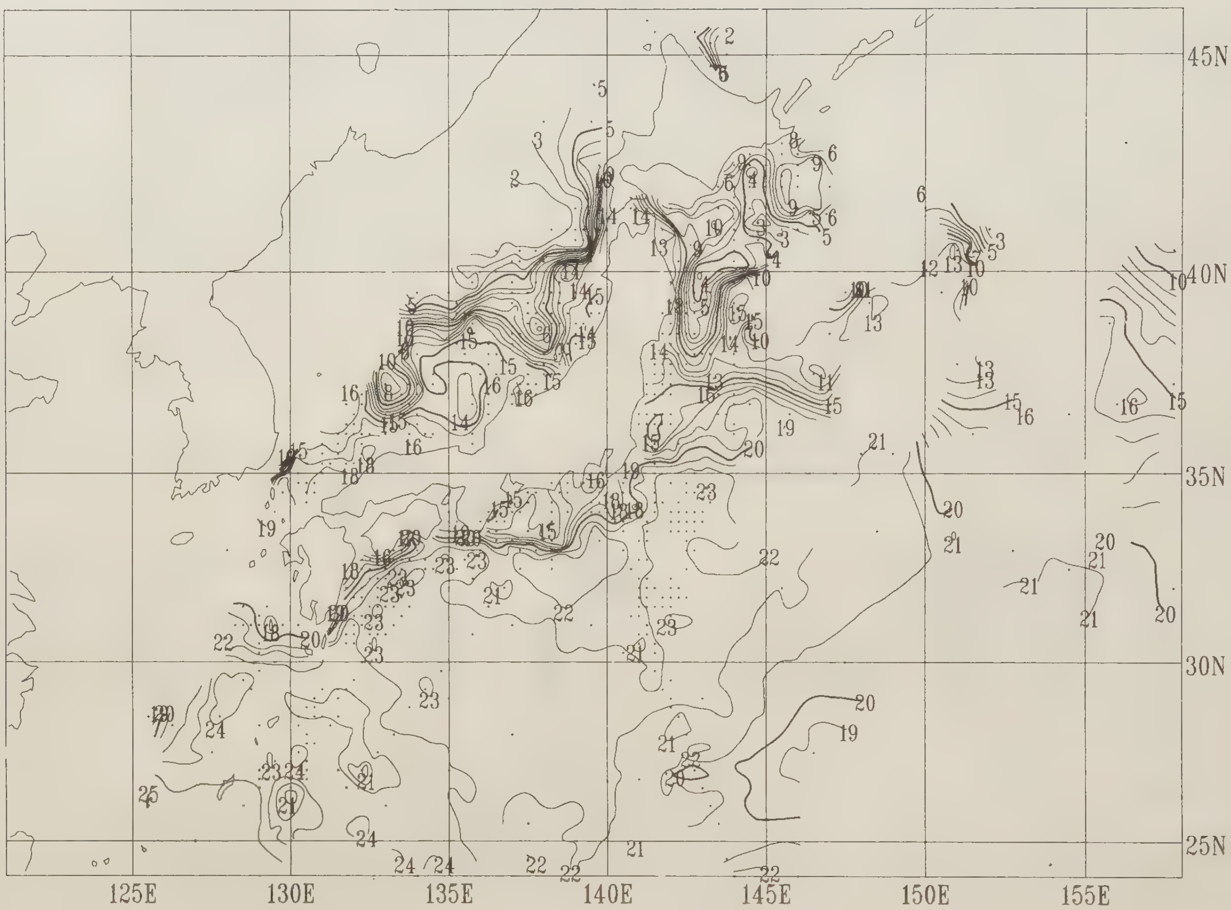
Fig.3 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 3rd ten-day period in DEC 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



第4図 北西太平洋月平均海面水温図(上)及び偏差図(下)(1997年12月)

Fig.4 Monthly mean SST (top) and anomalies (bottom) in the western North Pacific for DEC 1997. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.

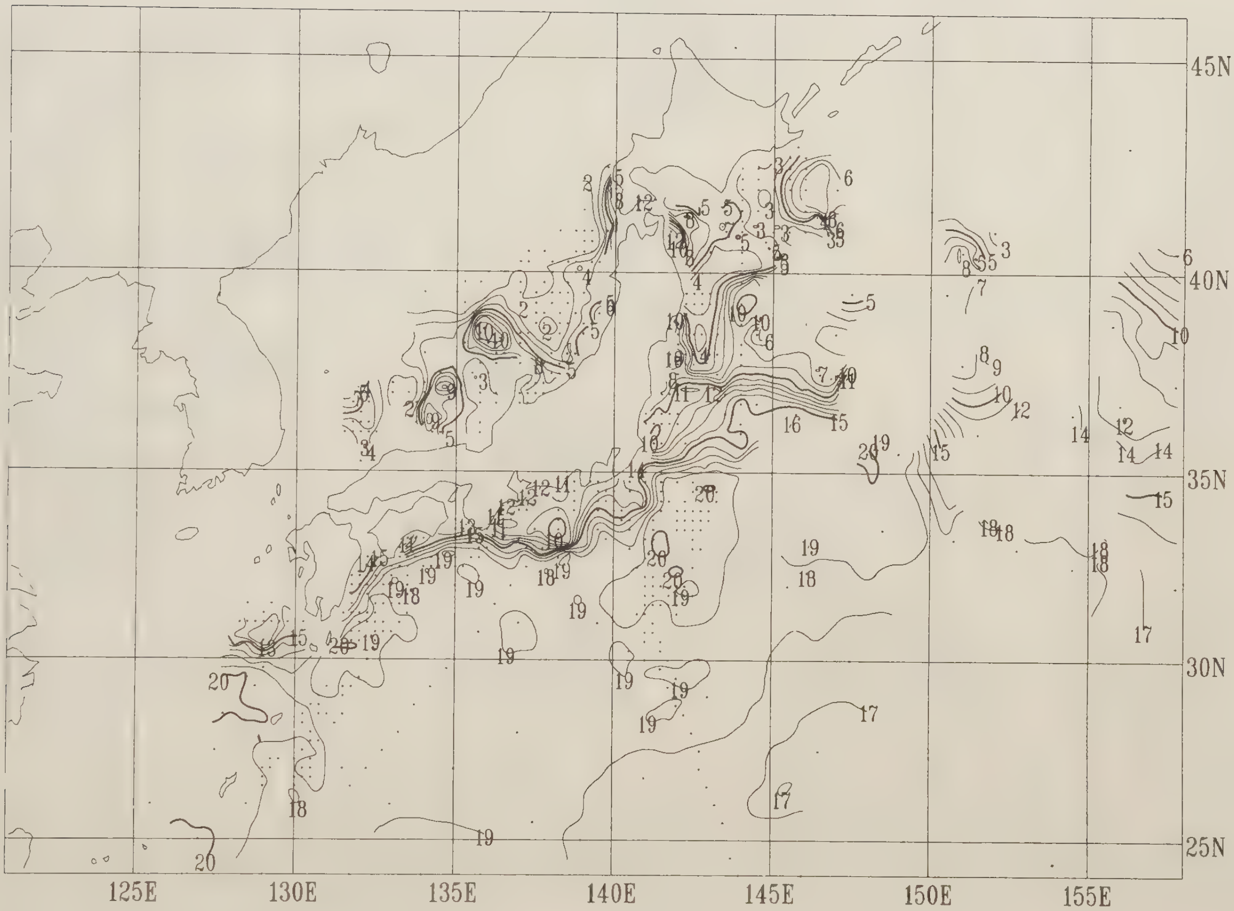
100m Temperatures in the Seas Adjacent to Japan



第5図　日本近海表層水温図(深さ100m) (1997年12月)

Fig.5 Subsurface (100m) temperatures in the seas adjacent to Japan for DEC 1997. Contour interval is 1°C. Observation points are denoted by dots.

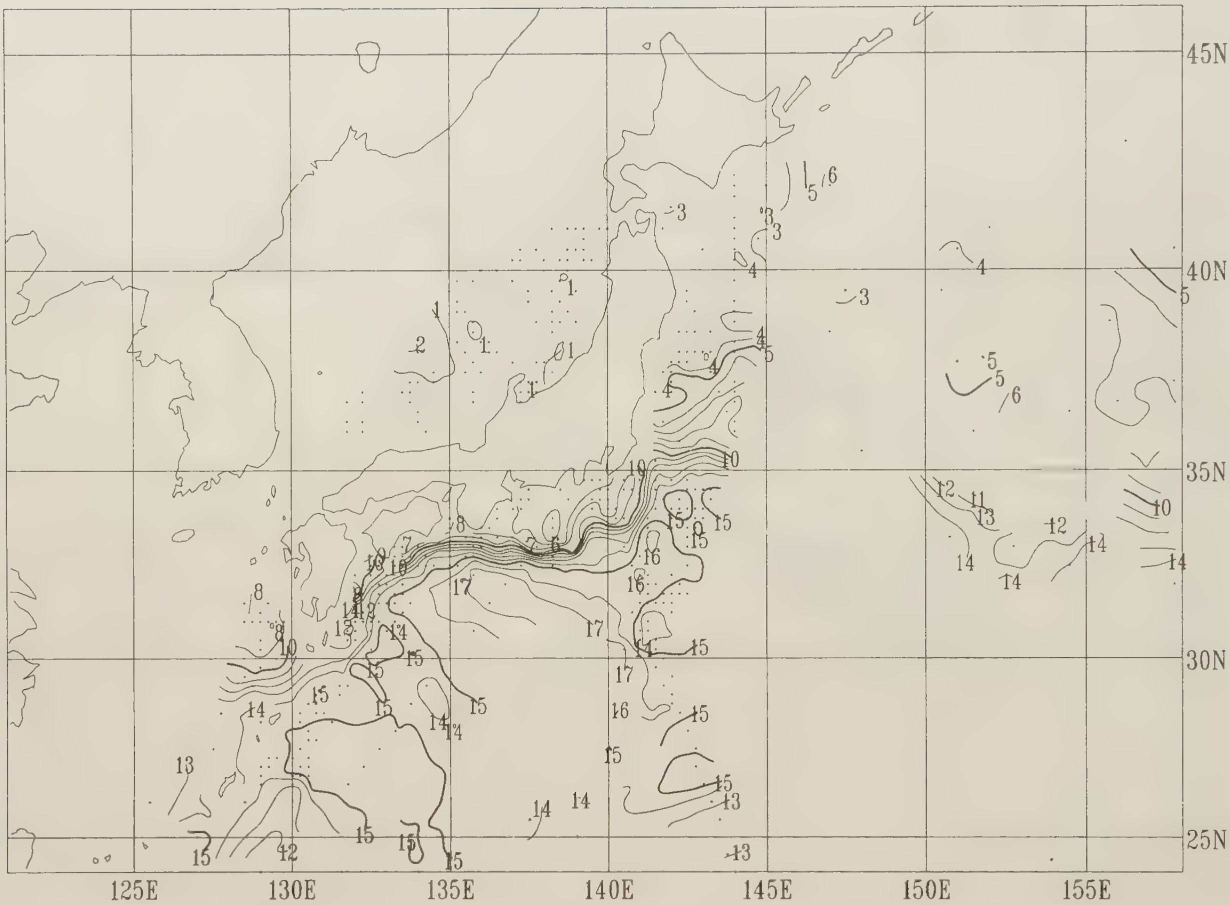
200m Temperatures in the Seas Adjacent to Japan



第6図　日本近海表層水温図(深さ200m)(1997年12月)

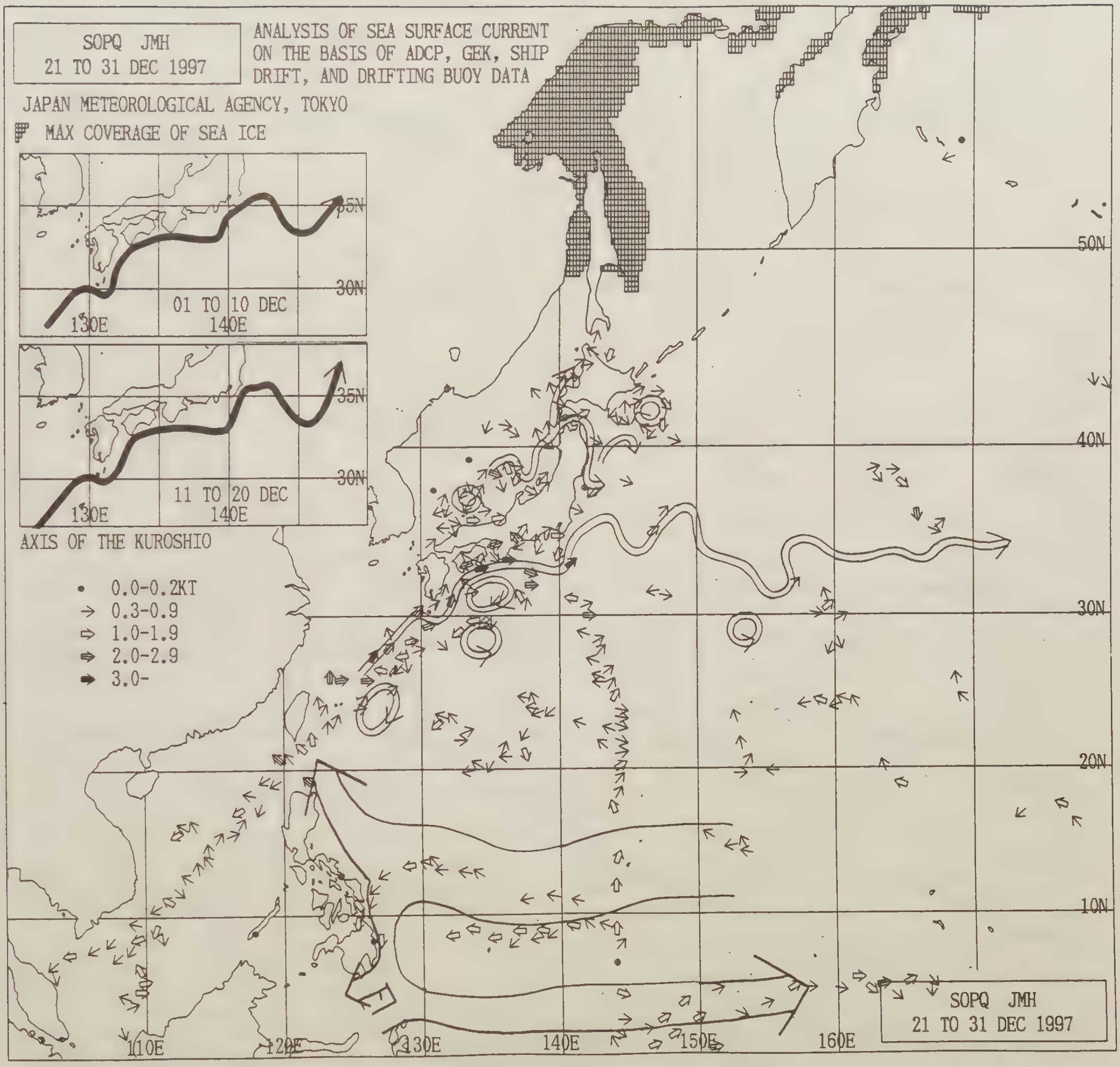
Fig.6 Subsurface (200m) temperatures in the seas adjacent to Japan for DEC 1997. Contour interval is 1°C. Observation points are denoted by dots.

400m Temperatures in the Seas Adjacent to Japan



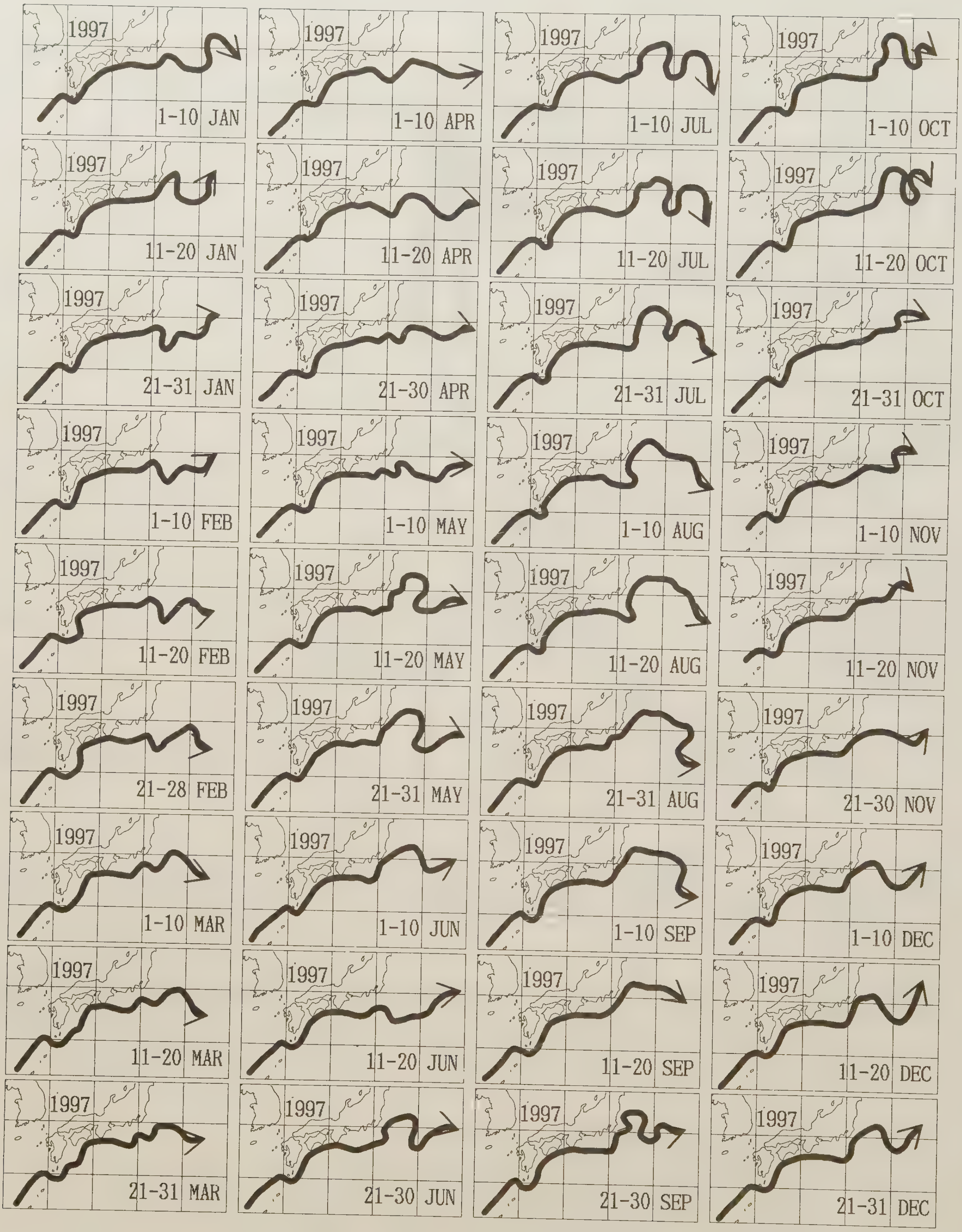
第7図　日本近海表層水温図(深さ400m)(1997年12月)

Fig.7 Subsurface (400m) temperatures in the seas adjacent to Japan for DEC 1997. Contour interval is 1°C. Observation points are denoted by dots.



第8図　北西太平洋海流図（1997年12月下旬）

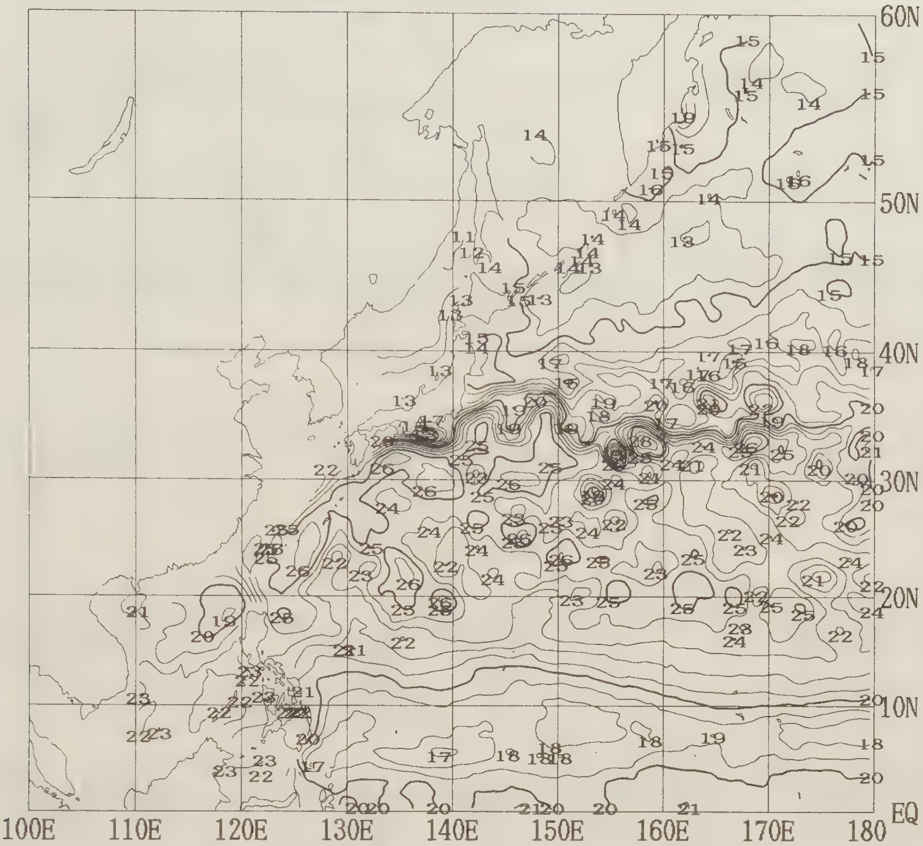
Fig.8 Analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in DEC 1997. Small arrows indicate in situ observations. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.



第9図 旬別黒潮流軸図

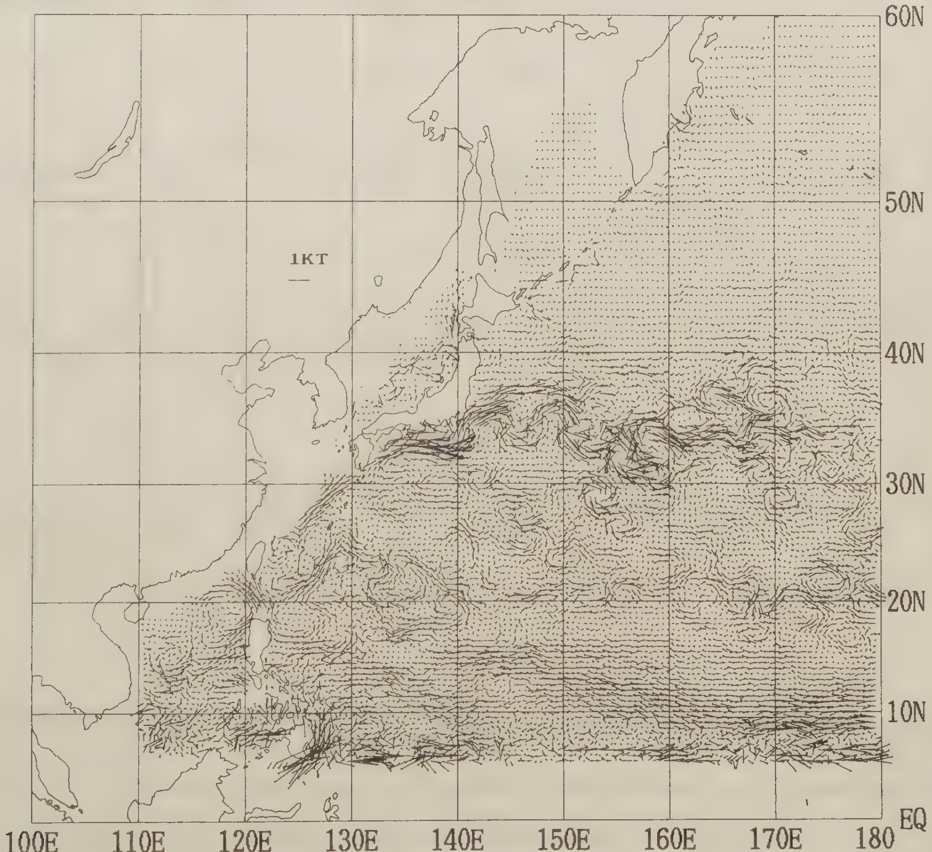
Fig.9 Location of the Kuroshio axis

Sea surface dynamic heights and current distribution



第10図 北西太平洋力学的海面高度分布図(1997年12月14日)

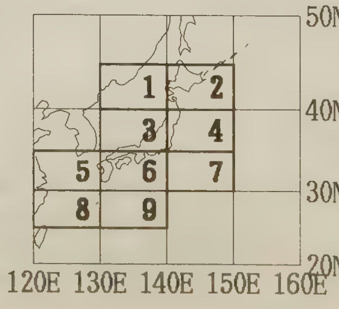
Fig.10 Sea surface dynamic heights (10cm) in the western North Pacific derived from the altimeter data of TOPEX/POSEIDON (DEC 14, 1997).
1500db surface is assumed to be the surface of no motion.



第11図 北西太平洋海流ベクトル図(1997年12月14日)

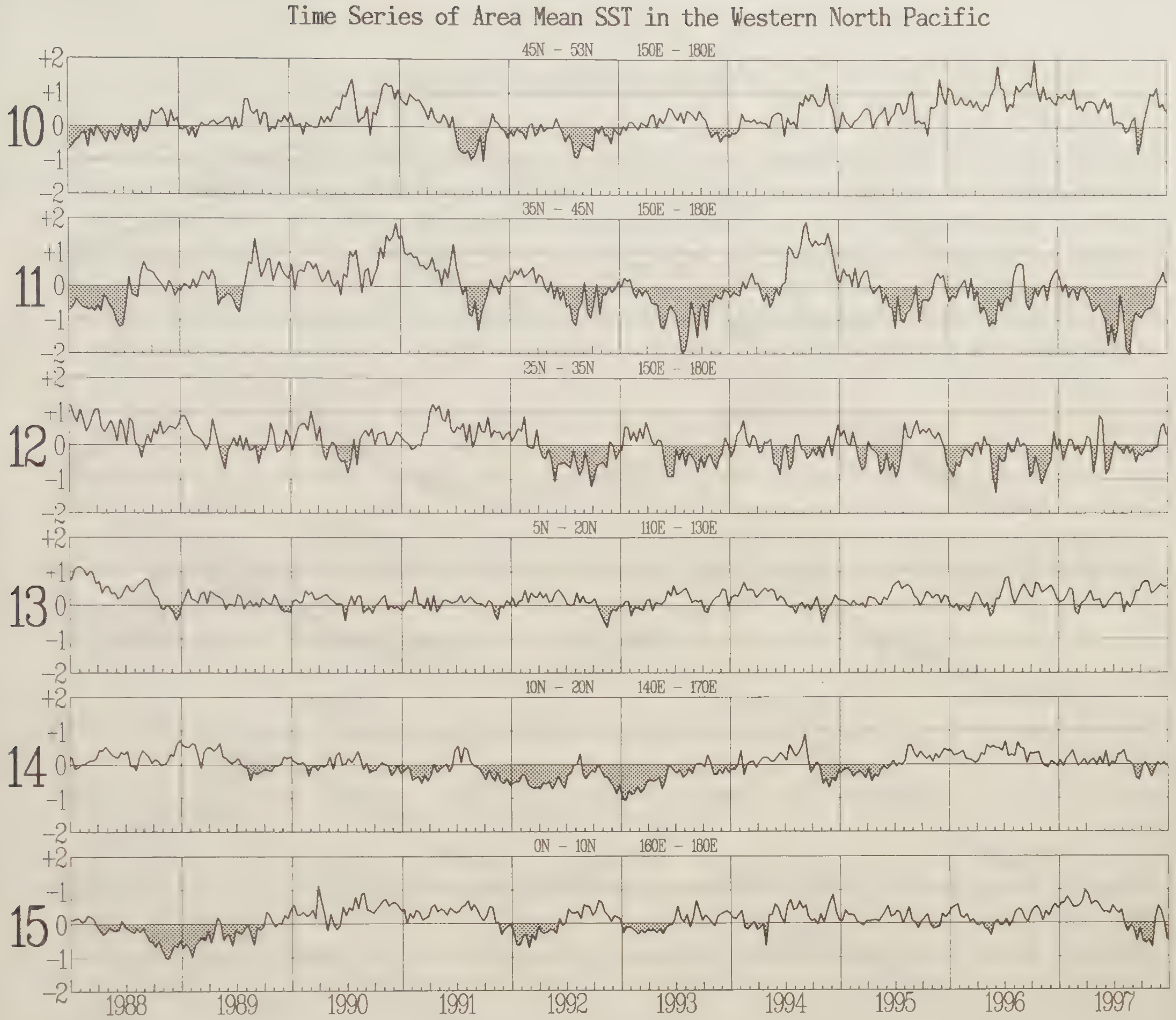
Fig.11 Sea surface current vectors in the western North Pacific (DEC 14, 1997).
Vectors are derived from the sea surface dynamic heights from TOPEX/POSEIDON and subsurface temperature distribution assuming the geostrophic relation.





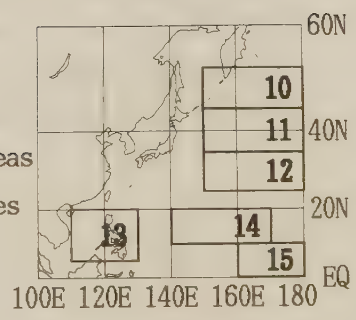
第12図　海域別旬平均海面水温平年偏差時系列図

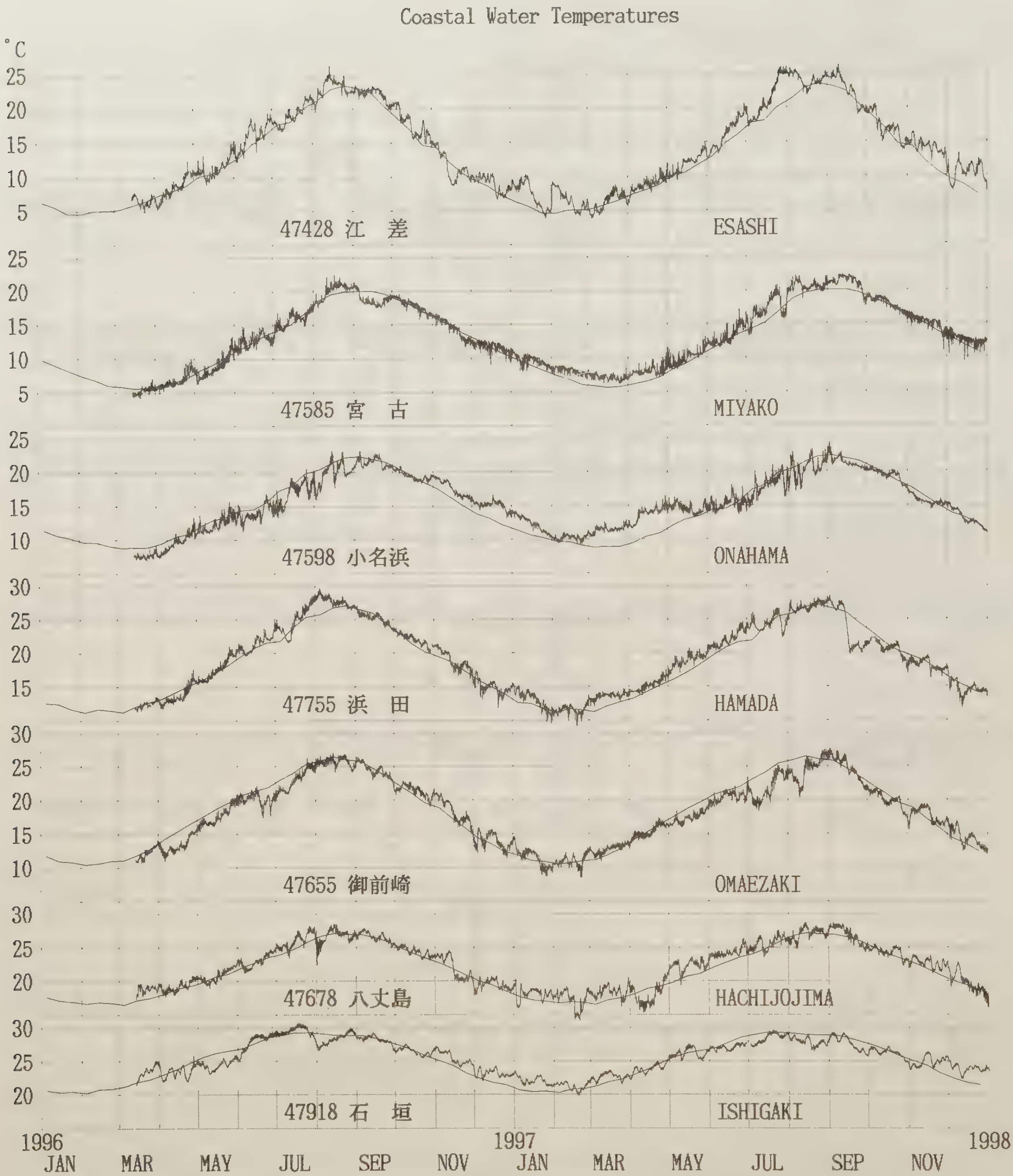
Fig.12 Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

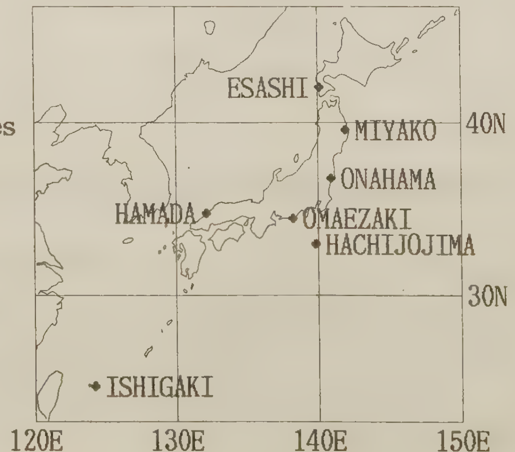


第12図　海域別旬平均海面水温平年偏差時系列図（つづき）

Fig.12 (continue) Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).



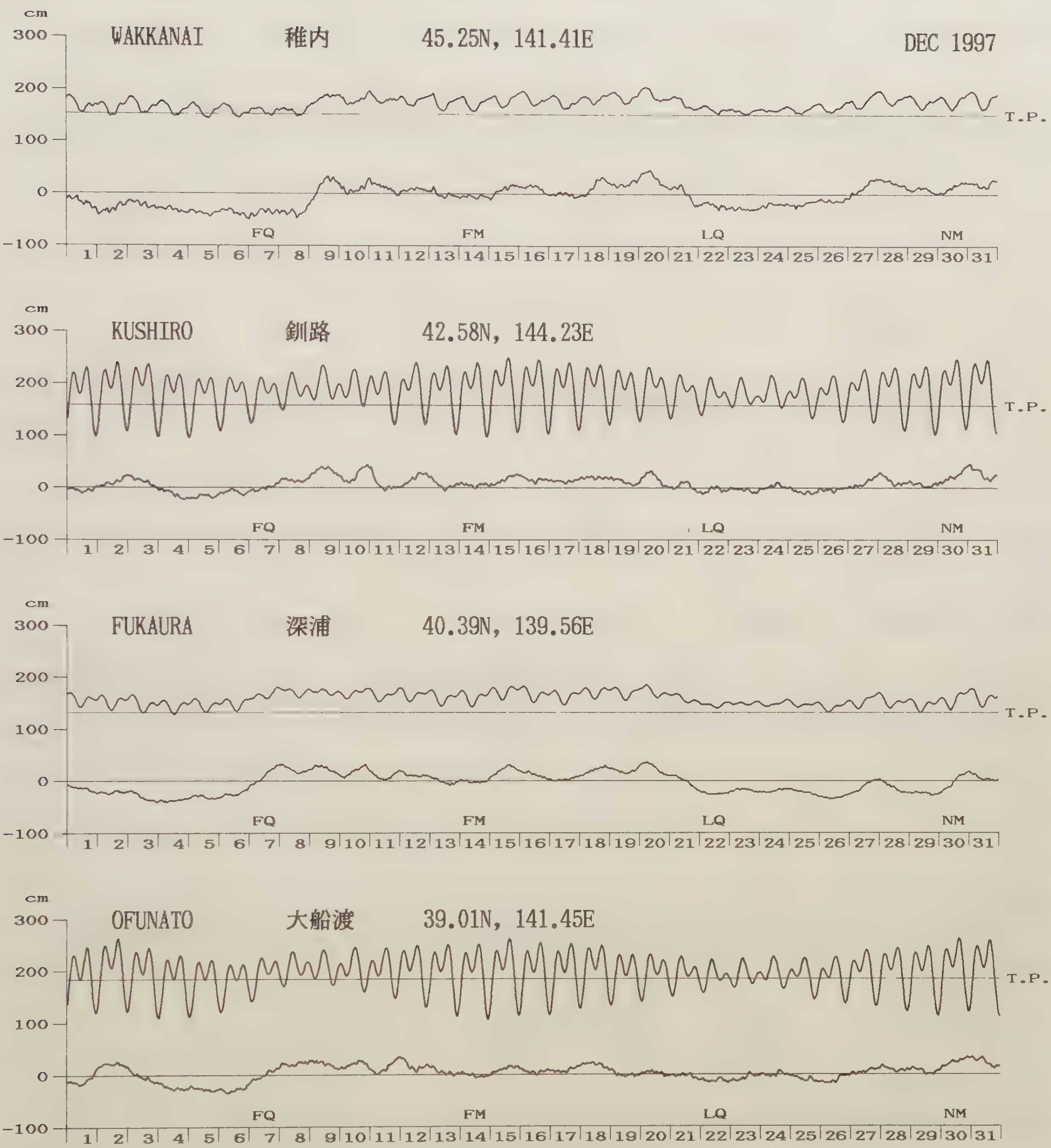




第13図 沿岸水温時系列図

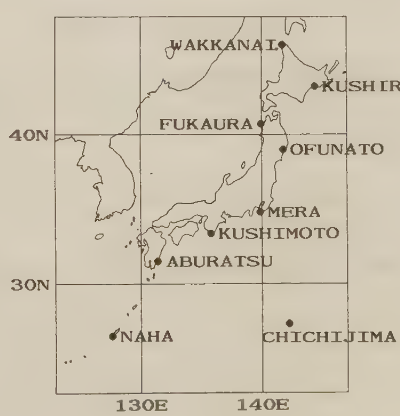
Fig.13 Time series of hourly coastal water temperatures (°C) measured at 7 coastal stations of the JMA shown in the right panel.
Thin lines show ten-day mean climatology.

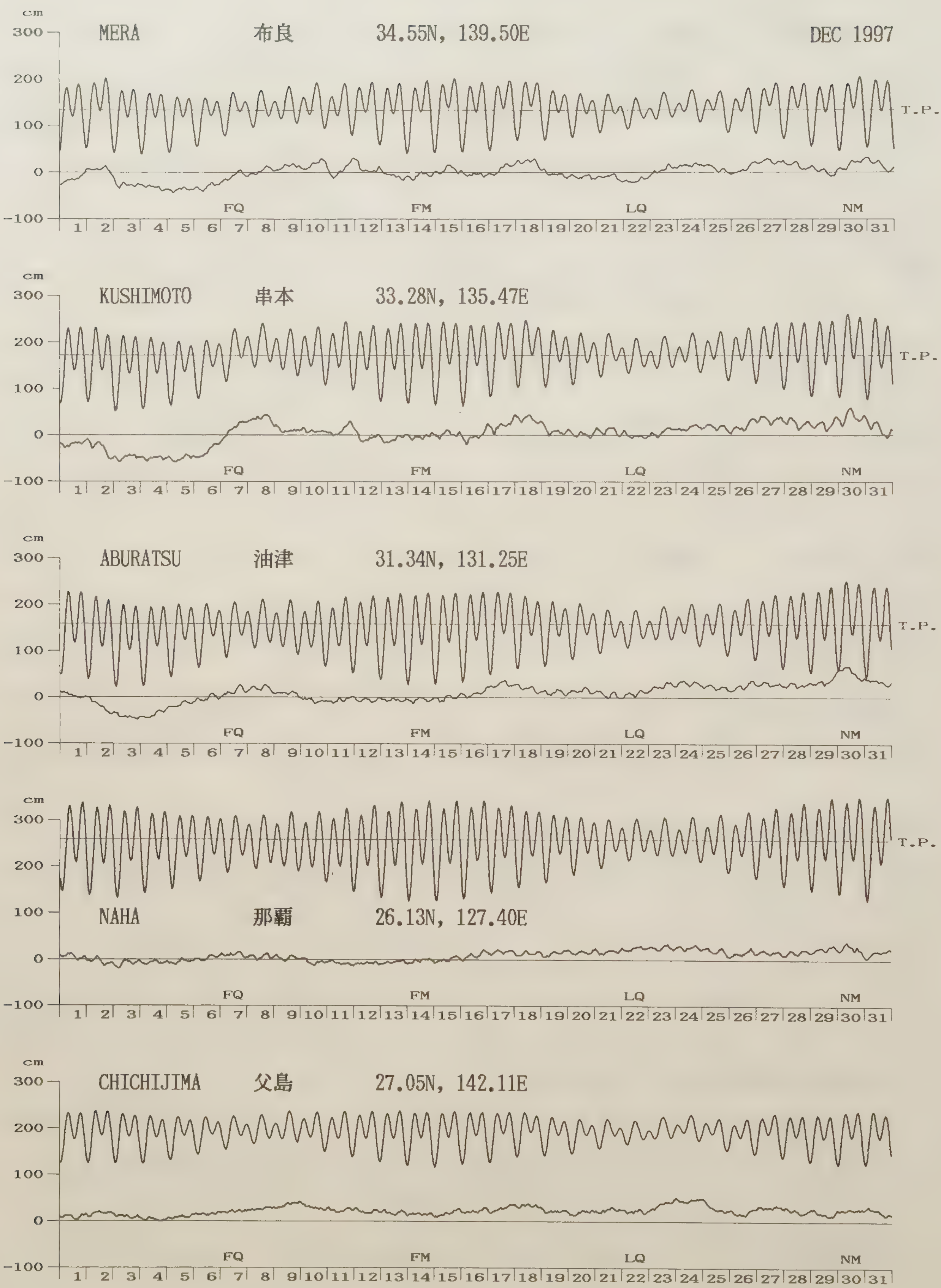
Time Series of Sea Level



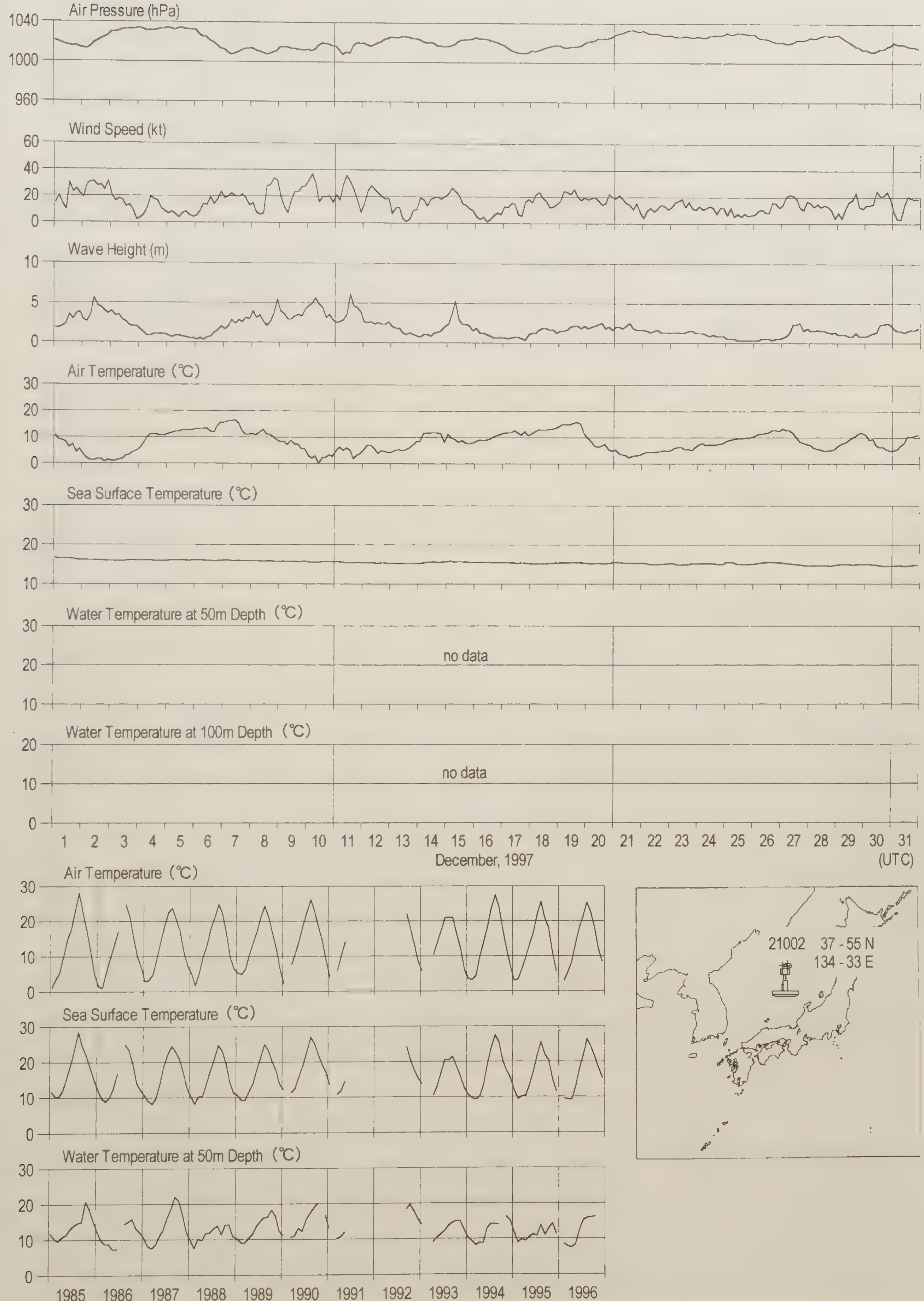
第14図 沿岸潮位時系列図（1997年12月）

Fig.14 Time series of hourly sea level observation (upper line) and its anomalies (lower line) at 9 stations of the JMA in the right panel.
Short term variations are removed from raw data.
Sea level anomalies are two times values of the differences between the observations and the predicted astronominal tide.
FM: full moon, FQ: first quarter
NM: new moon, LQ: last quarter
T.P.: Mean sea level of Tokyo Bay (Tokyo Peil)



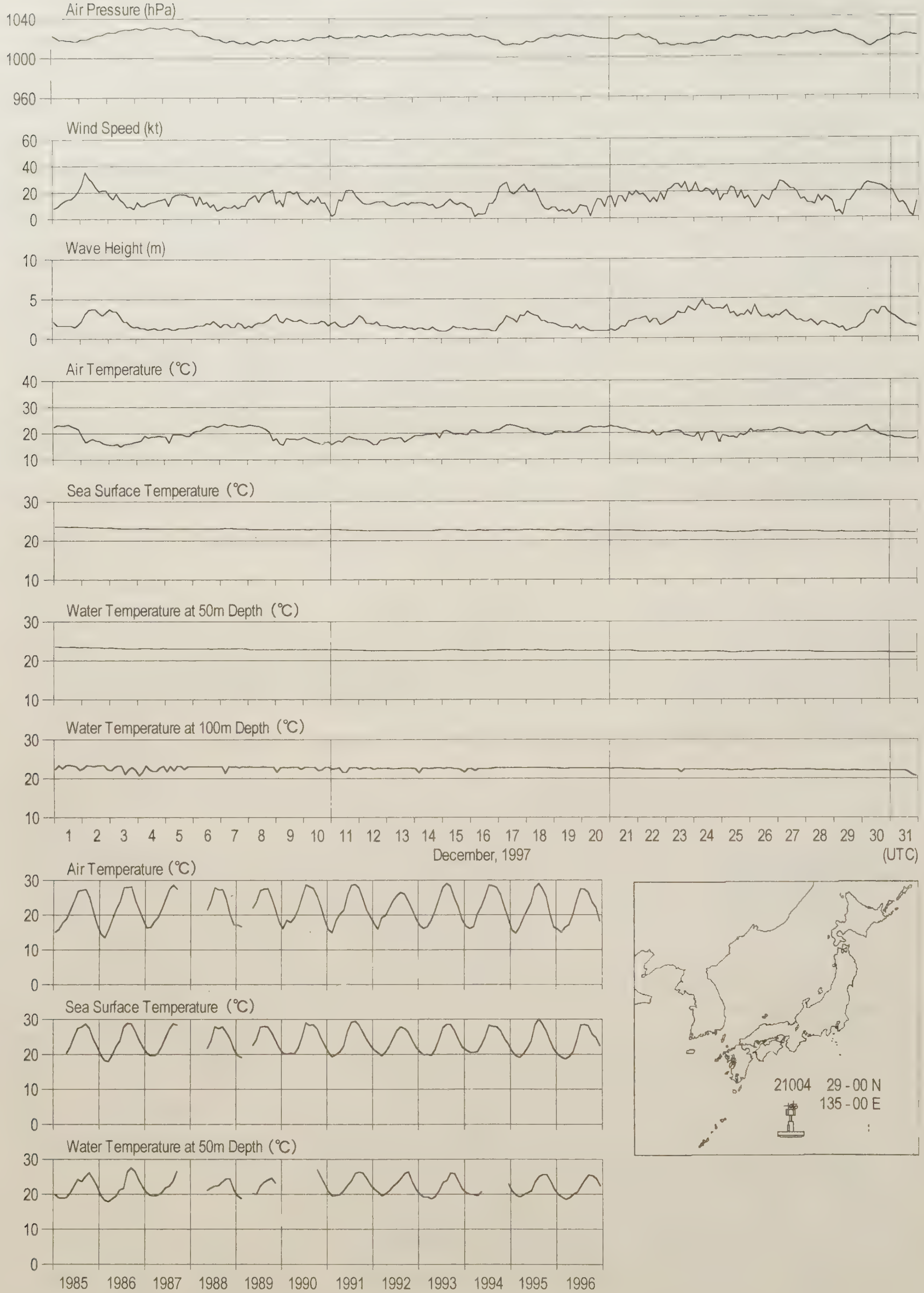


第14図 つづき
Fig.14 continue



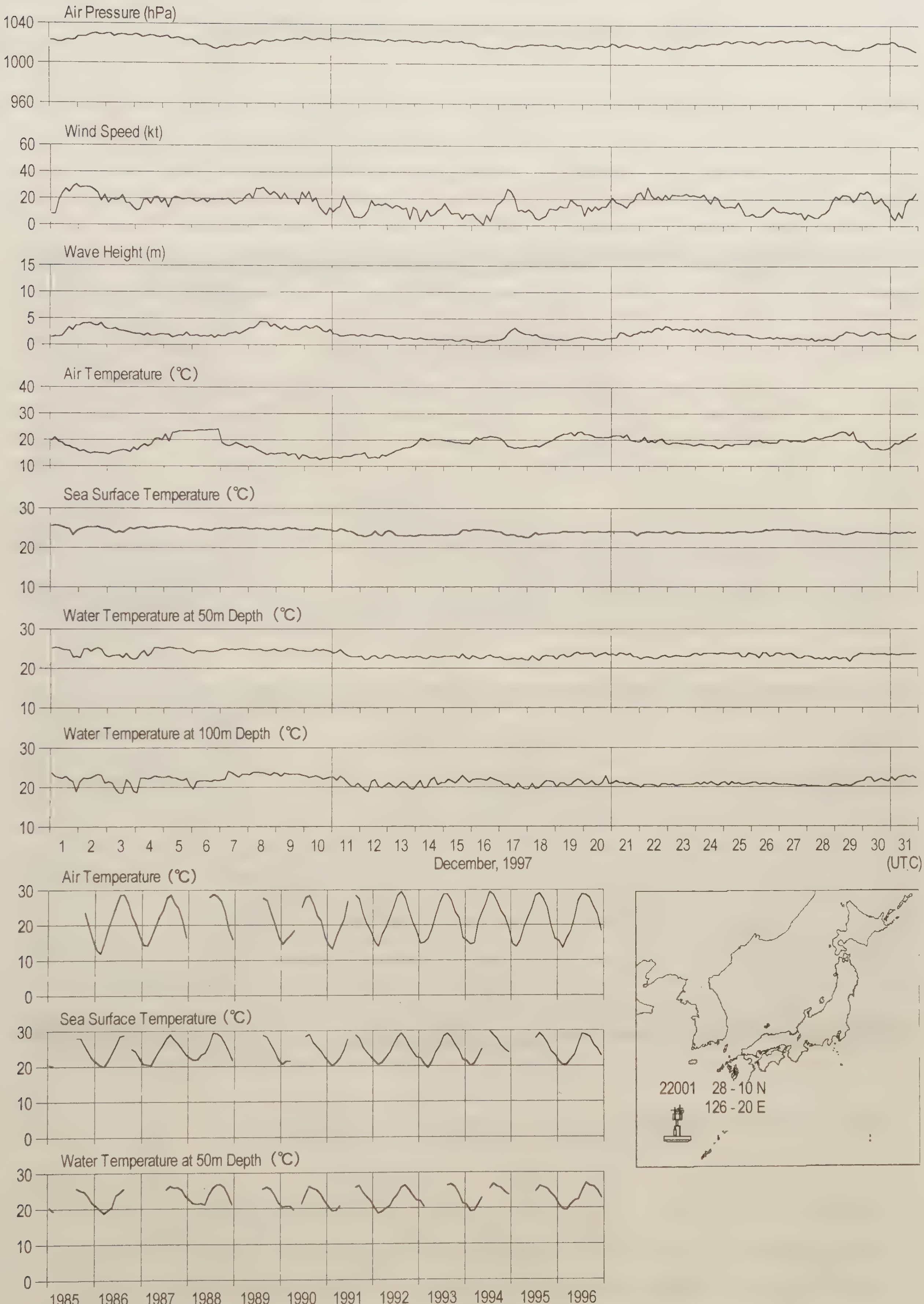
第15図　海洋気象ブイロボットによる観測要素の時系列図（日本海：21002）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the Japan Sea (WMO ID No. 21002).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



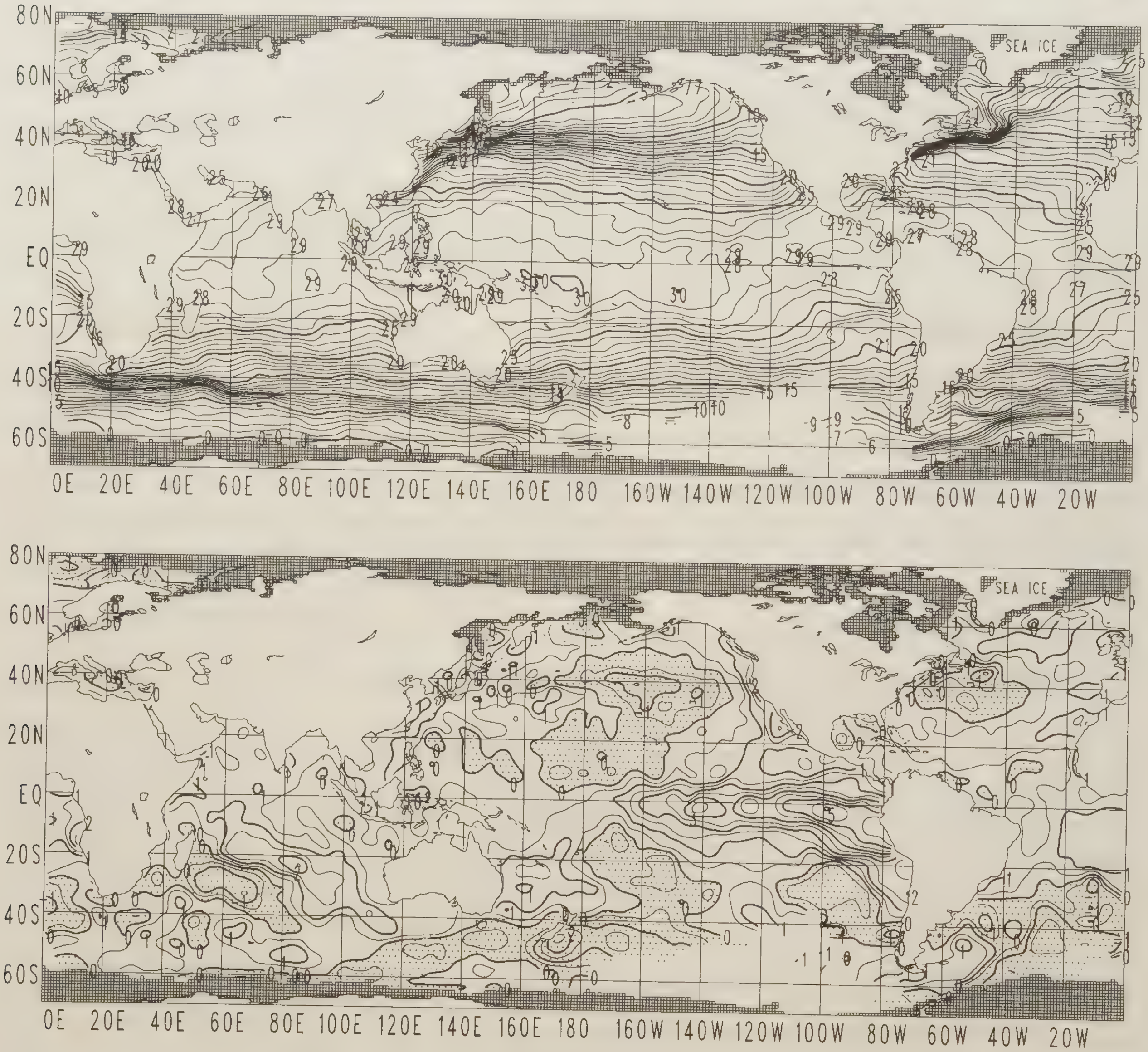
第15図　海洋気象ブイロボットによる観測要素の時系列図（四国沖：21004）
上段は3時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation south of Shikoku (WMO ID No. 21004).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



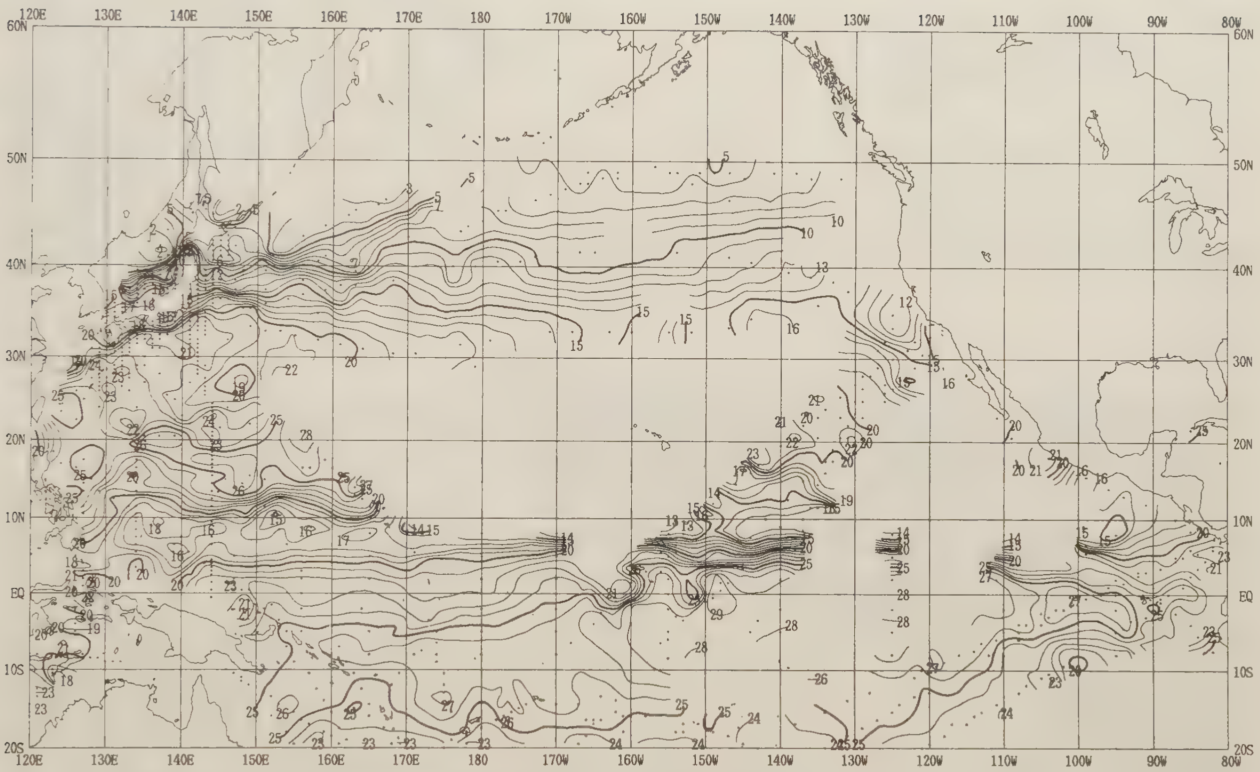
第15図　海洋気象ブイロボットによる観測要素の時系列図（東シナ海：22001）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the East China Sea (WMO ID No. 22001).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



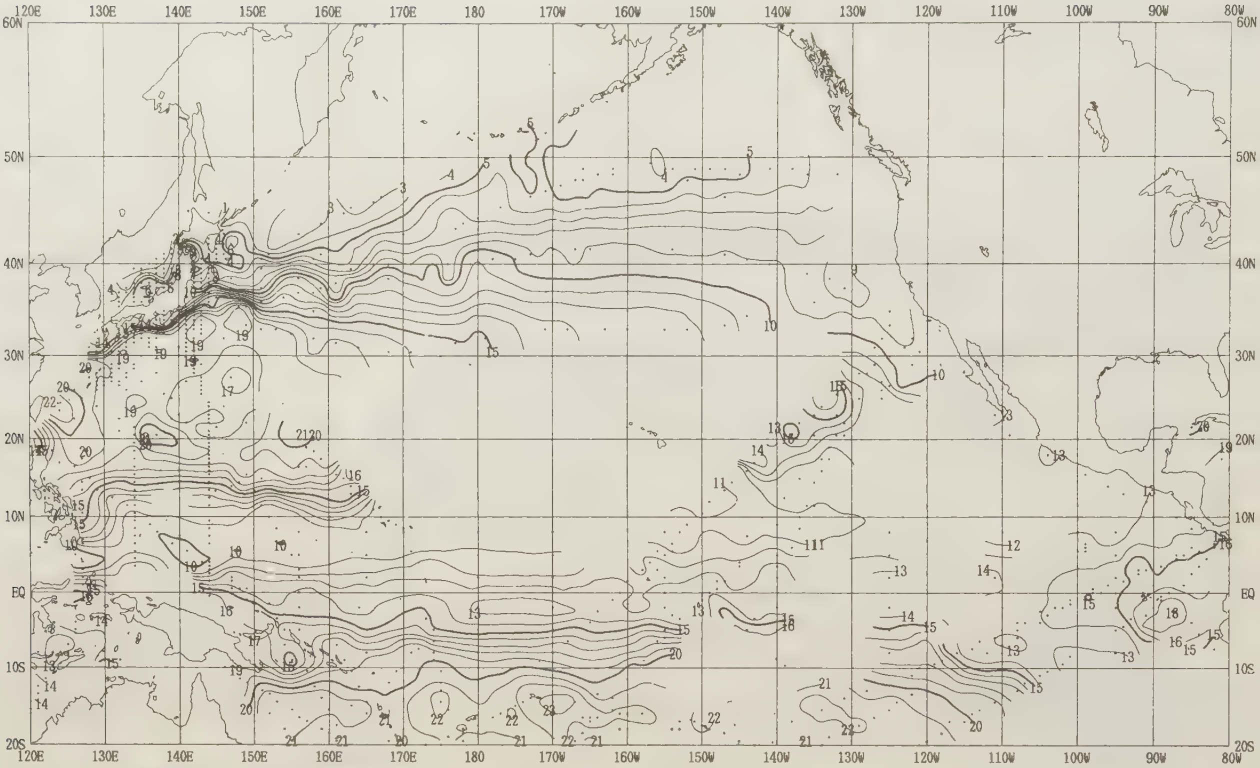
第16図　全球月平均海面水温図（上）及び偏差図（下）（1997年12月）

Fig.16 Monthly mean sea surface temperature over the global ocean (top) and anomalies (bottom) for DEC 1997. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C (top) and additional anomaly contours of ±0.5°C are shown by thin lines. Negative anomalies are spotted. Maximum coverage of sea ice is shaded. Data sources for sea ice are U.S. National Ice Center (polar regions) and JMA (the Sea of Okhotsk).



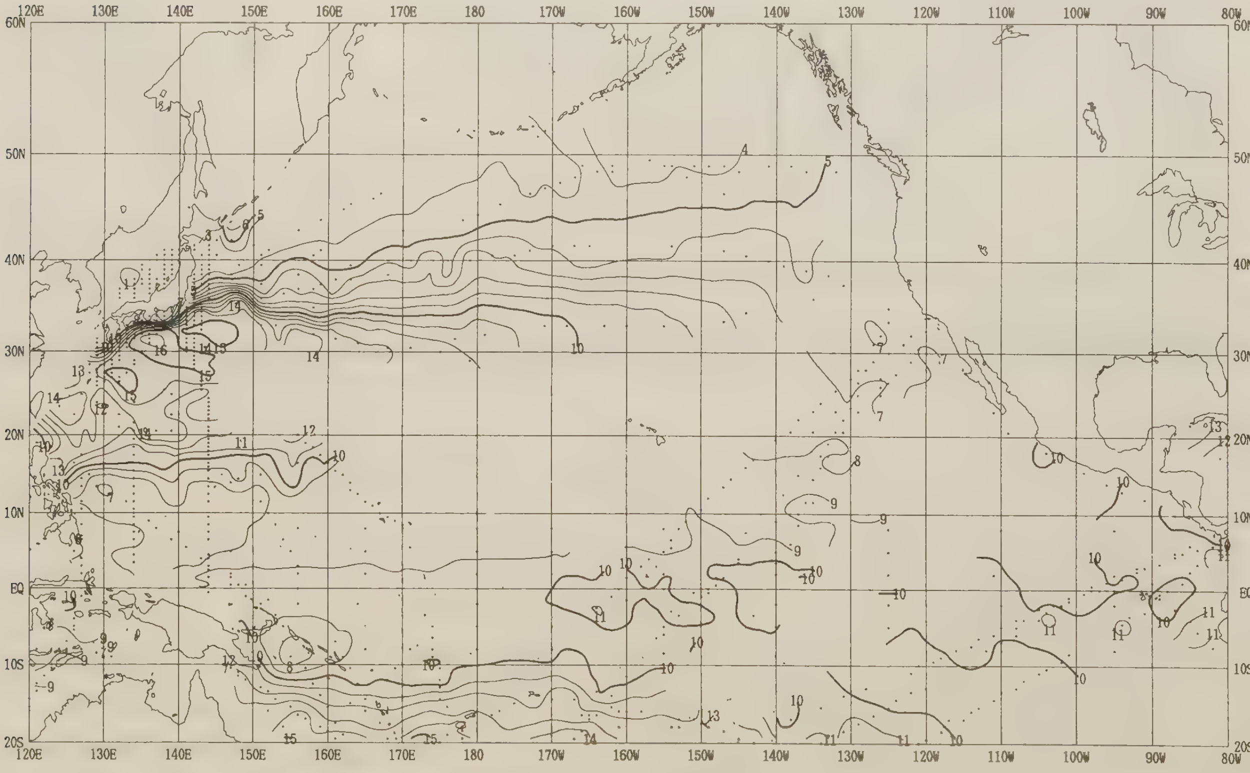
第17図　太平洋表層水温図(深さ100m) (1997年12月)

Fig.17 Subsurface (100m) temperatures in the Pacific Ocean for DEC 1997.
Contour interval is 1°C. Observation points are denoted by dots.



第18図　太平洋表層水温図(深さ200m)（1997年12月）

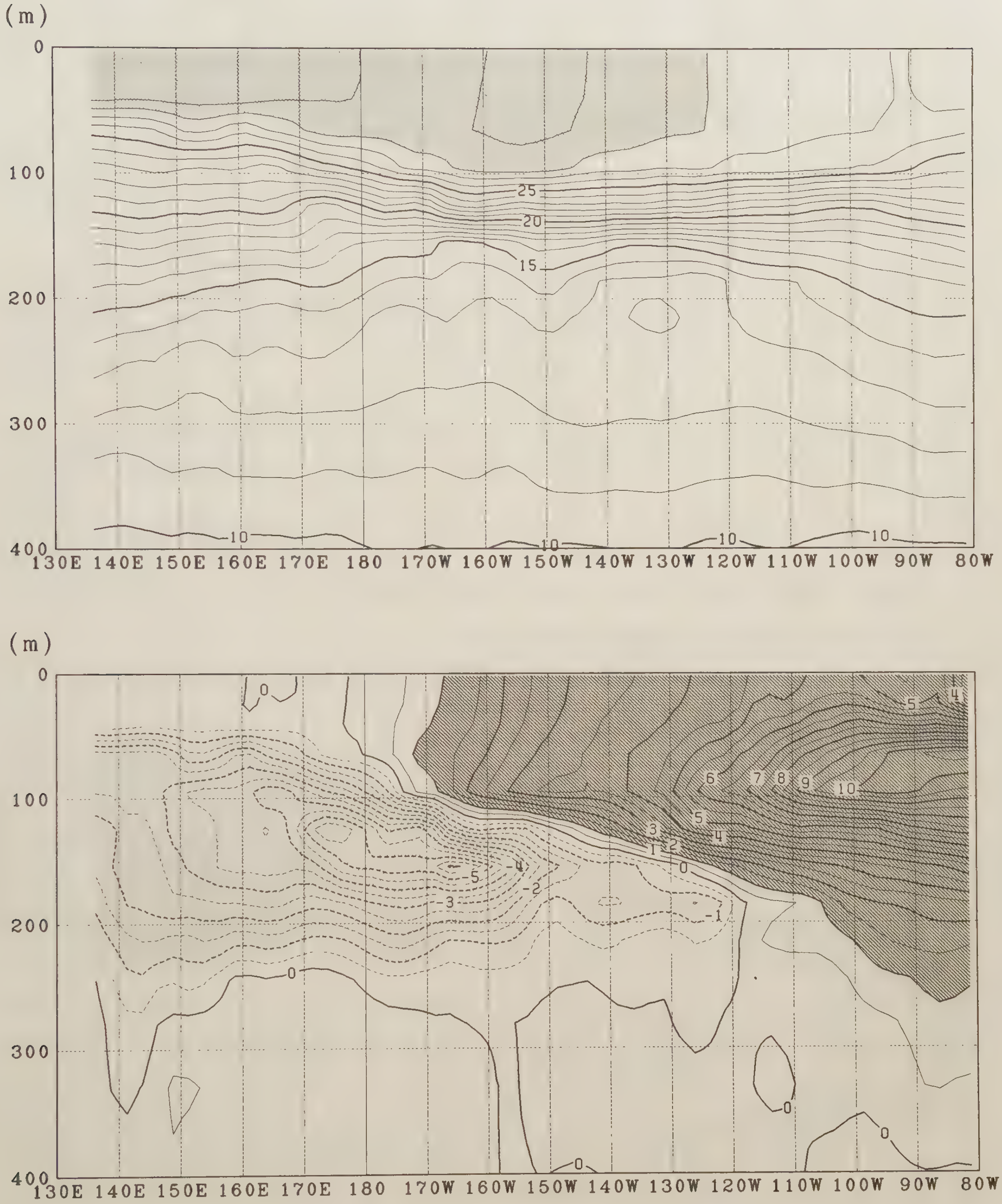
Fig.18 Subsurface (200m) temperatures in the Pacific Ocean for DEC 1997. Contour interval is 1°C. Observation points are denoted by dots.



第19図　太平洋表層水温図(深さ400m)（1997年12月）

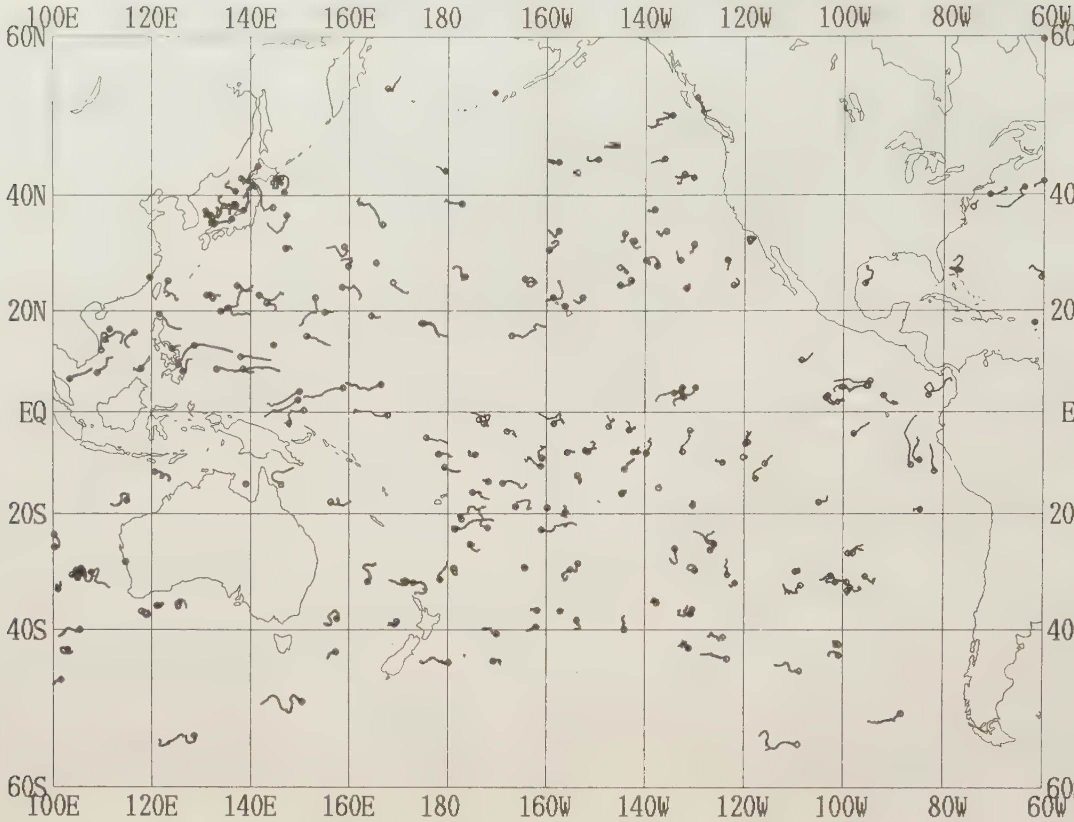
Fig.19 Subsurface (400m) temperatures in the Pacific Ocean for DEC 1997. Contour interval is 1°C. Observation points are denoted by dots.

Depth-Longitude Sections of Equatorial Temperature & Anomalies



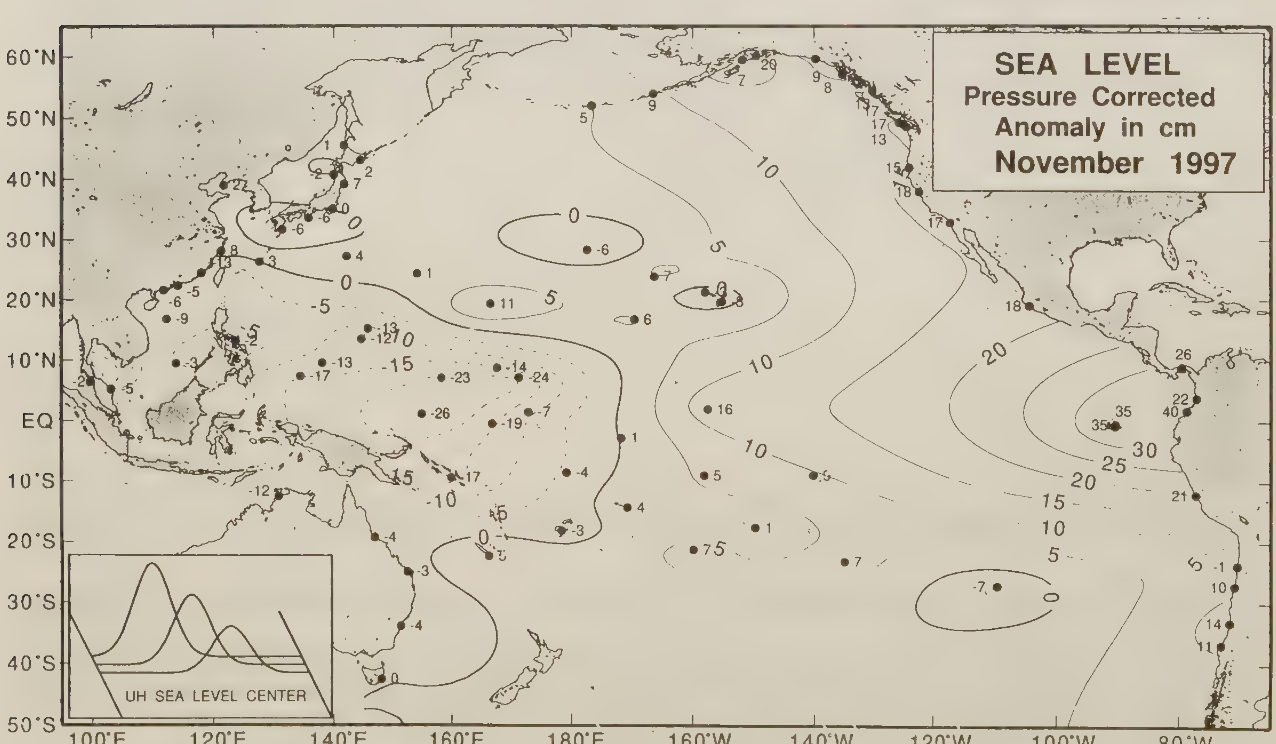
第20図　太平洋赤道に沿う表層水温（上）及び偏差（下）の深度－経度断面図（1997年12月）

Fig.20 Depth-longitude sections of temperature (top) and anomalies (bottom) along the equator in the Pacific Ocean for DEC 1997. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (top) and 0.5°C (bottom). Values greater than 28°C in the top panel are shaded. In the bottom panel, values greater than 1°C are shaded and values less than -1°C are spotted. Anomalies are computed from 1987-1996 base period means.



第21図　太平洋ブイ流跡図(1997年12月)

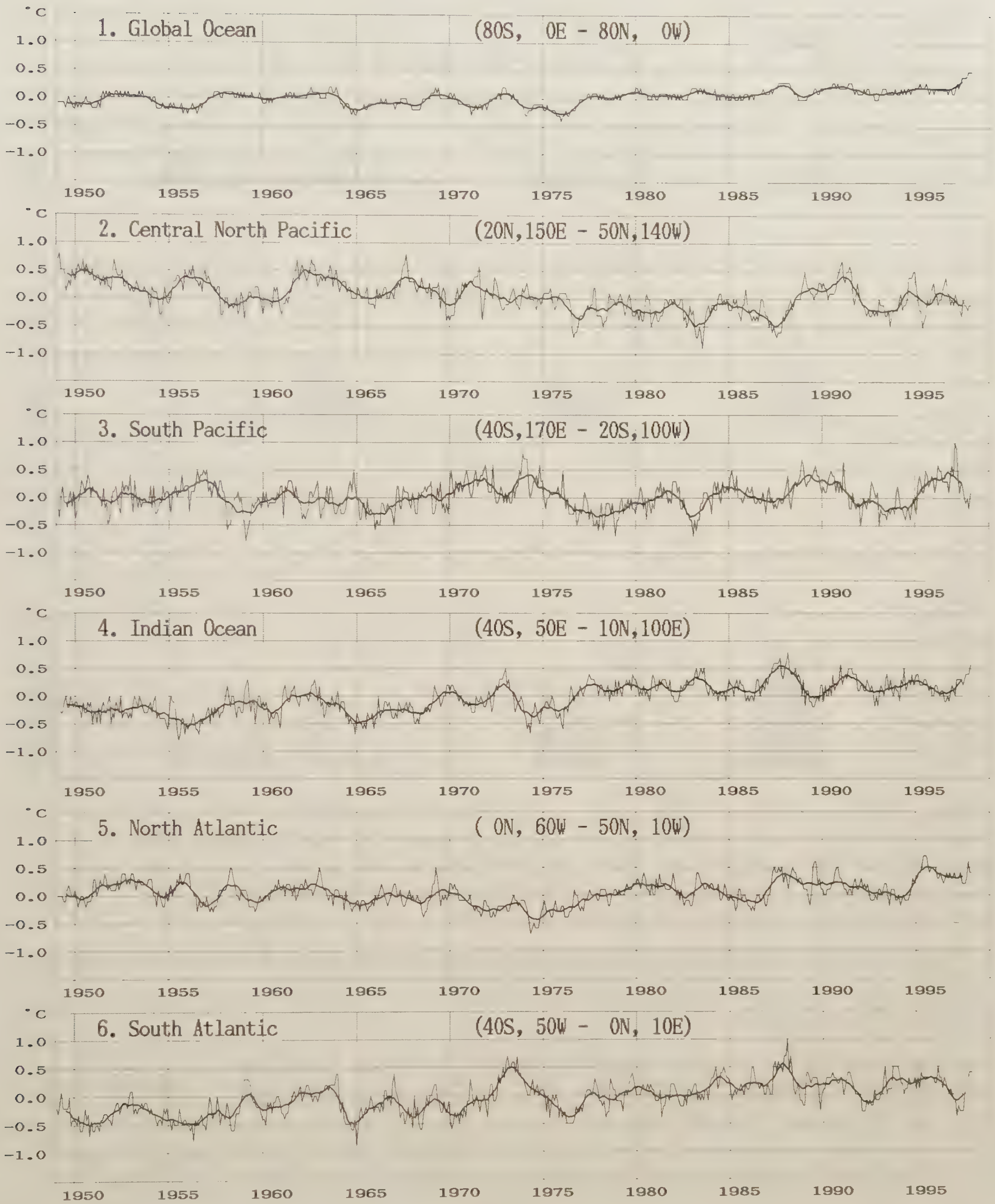
Fig.21 Movements of drifting buoys in the Pacific Ocean during DEC 1997.
Each track is for one buoy. Small circles represent last positions for the month.



第22図　太平洋海面水位偏差図 (1997年11月)

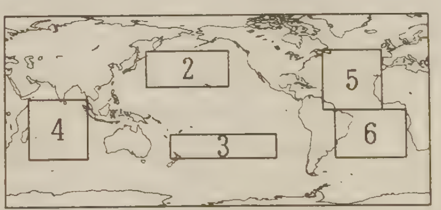
Fig.22 Monthly sea level anomalies for NOV 1997 obtained from mean sea level (1975-1995) adjusted for atmospheric pressure. This figure is prepared by the SOC of ISLP-PAC, Dept. of Oceanography, Univ. of Hawaii.

Long-term Variation of Monthly Mean SST Anomalies

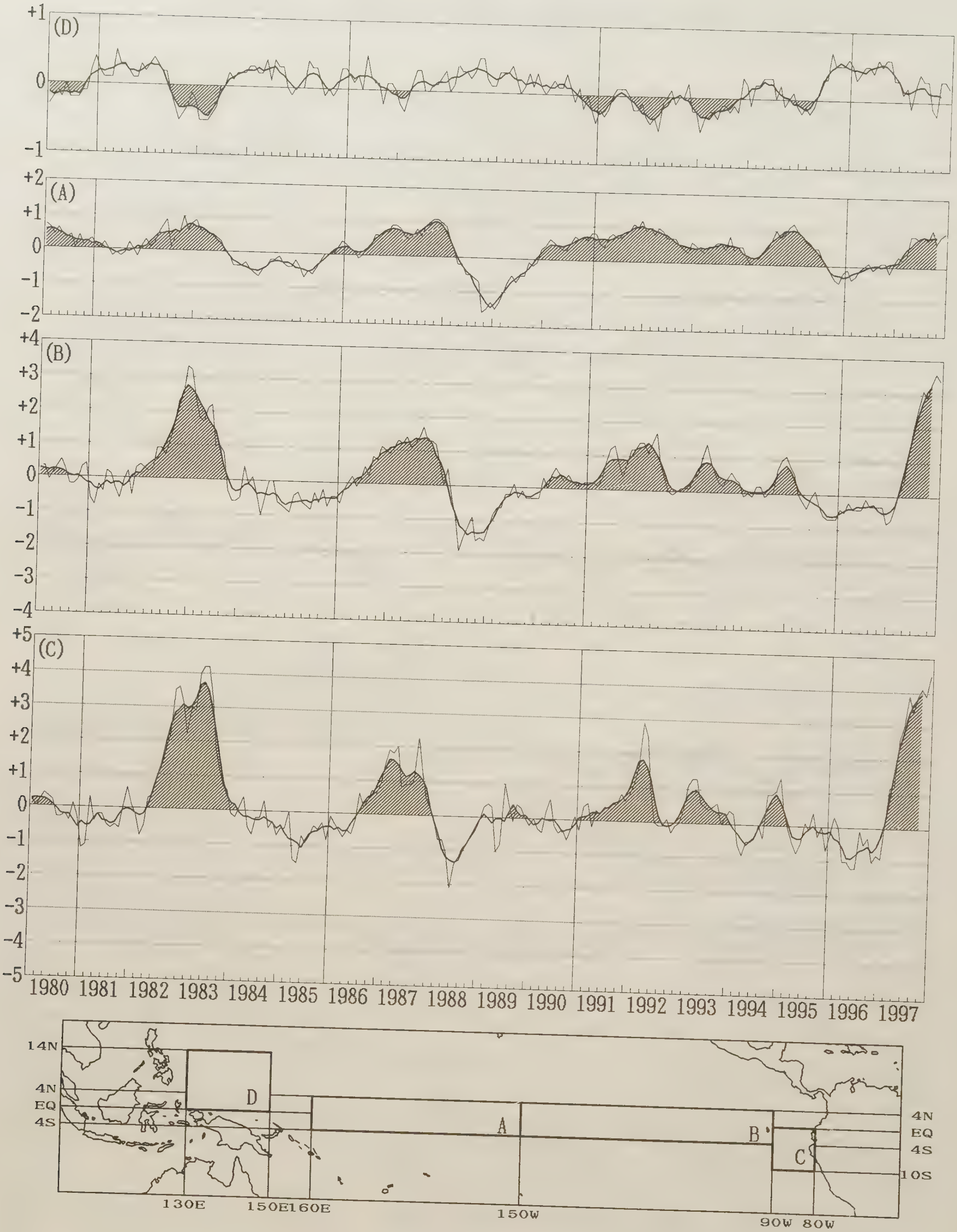


第23図 海域平均海面水温偏差の長期変動

Fig.23 Long-term variations of monthly mean sea surface temperature anomalies (°C) for the areas shown in the right panel. Anomalies are computed from the JMA climatology (1961-90). Thin lines show the monthly mean and thick lines their 13-month running means.



Time Series of Equatorial Pacific SST Anomalies



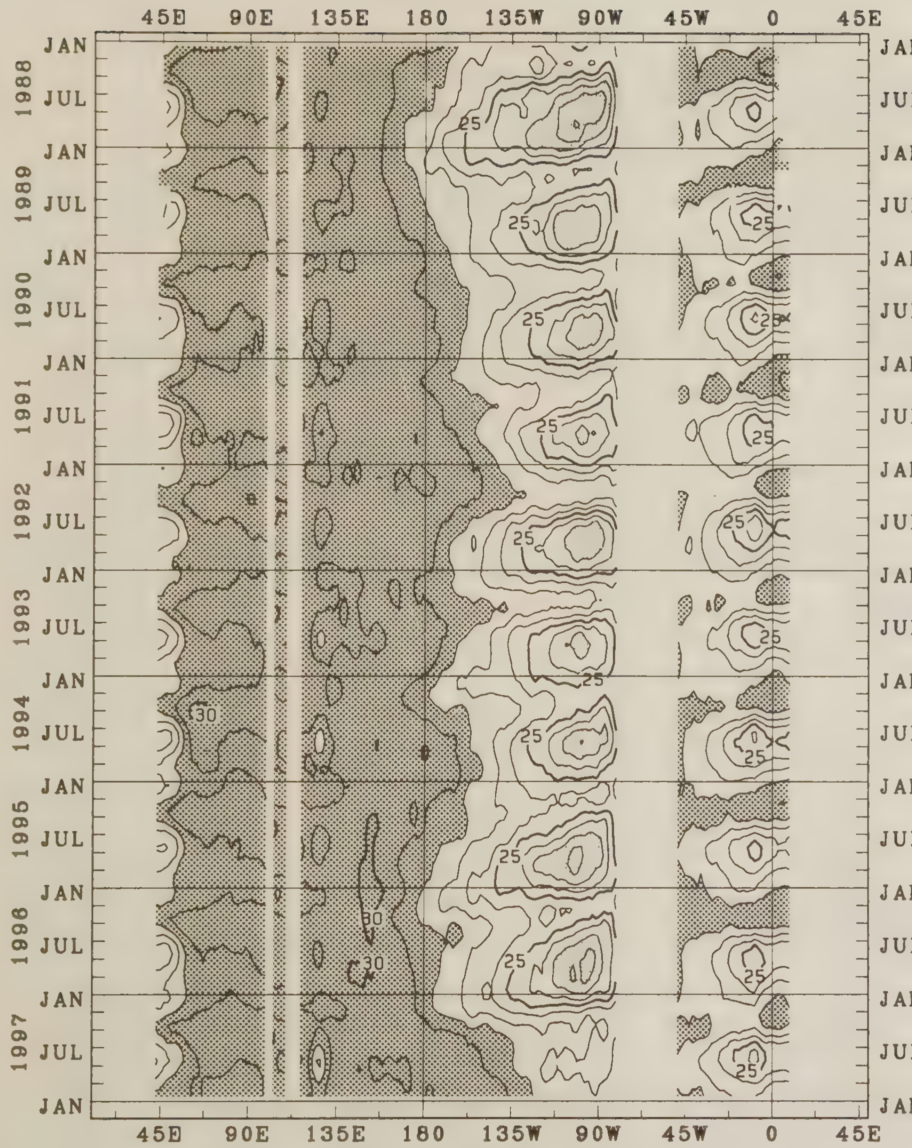
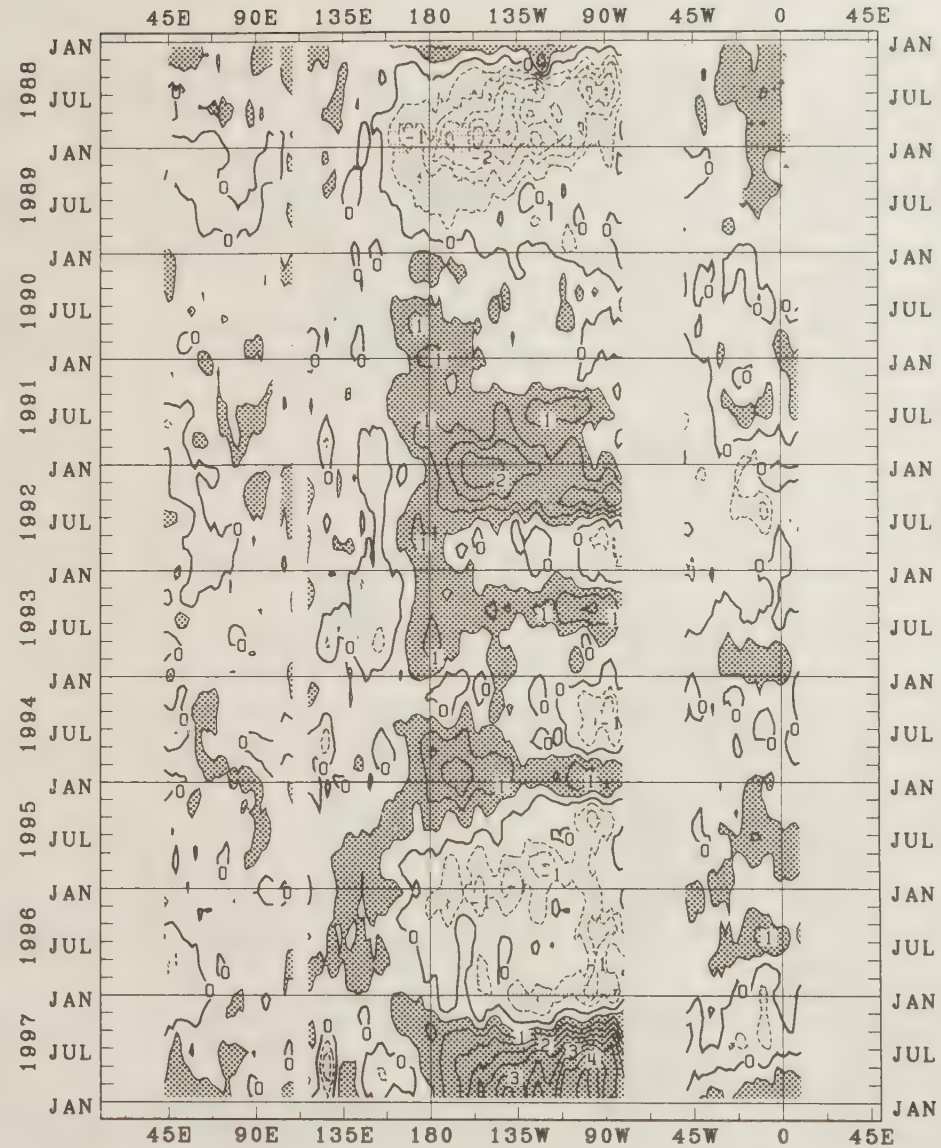
第24図　太平洋赤道域の海面水温偏差時系列図

Fig.24 Time series of monthly mean SST anomalies (°C) in the equatorial Pacific Ocean for the areas indicated at the bottom panel. Thin lines show the monthly means and thick lines their 5-month running means. Positive anomalies (A, B, C) and negative anomalies (D) are shaded. Anomalies are computed from the JMA climatology (1961-1990).

MONTH	SEA SURFACE TEMPERATURE AND ANOMALY (°C) REGION D 14N-EQ 130E-150E		REGION A 4N-4S 160E-150W		REGION B 4N-4S 150W-90W		REGION C EQ-10S 90W-80W		SOI	SEA LEVEL PRESSURE ANOMALY (hPa) TAHITI 17-33S 149-37W	DARWIN 12-24S 130-52E
JAN 95	28.3	-0.2	29.0	1.0	26.2	0.8	25.7	1.4	-0.4	-0.3	0.6
FEB 95	28.2	-0.1	28.9	0.9	26.8	0.6	26.1	0.4	-0.2	0.6	1.1
MAR 95	28.2	-0.2	28.8	0.7	26.9	0.0	25.8	-0.1	0.4	0.3	-0.5
APR 95	28.7	-0.1	28.8	0.6	26.9	-0.2	24.6	-0.5	-1.4	-1.6	-0.0
MAY 95	29.2	0.1	29.0	0.5	26.2	-0.4	23.1	-0.8	-1.0	-0.7	0.6
JUN 95	29.6	0.3	29.0	0.5	26.0	-0.1	22.2	-0.5	-0.1	0.3	0.4
JUL 95	29.5	0.3	28.7	0.2	25.3	0.1	21.7	0.1	0.4	0.4	-0.4
AUG 95	29.8	0.7	28.4	0.0	24.3	-0.3	20.5	-0.1	0.0	0.4	0.3
SEP 95	29.7	0.5	28.1	-0.2	24.0	-0.6	20.7	0.4	0.2	0.4	-0.0
OCT 95	29.8	0.5	28.0	-0.4	23.9	-0.7	20.4	-0.3	-0.3	-0.7	-0.5
NOV 95	29.7	0.5	27.9	-0.5	23.9	-0.7	21.5	0.0	0.1	0.1	-0.1
DEC 95	29.5	0.6	28.0	-0.2	24.2	-0.7	21.9	-0.7	-0.5	-0.9	0.0
JAN 96	29.0	0.5	27.9	-0.1	25.0	-0.4	24.1	-0.2	0.8	1.0	-0.7
FEB 96	28.6	0.3	27.6	-0.4	25.7	-0.5	26.0	0.3	0.1	-0.2	-0.5
MAR 96	28.8	0.4	27.8	-0.3	26.7	-0.2	25.9	0.0	0.7	1.0	-0.3
APR 96	29.3	0.5	28.1	-0.1	26.7	-0.4	24.1	-1.0	0.8	0.5	-0.5
MAY 96	29.6	0.5	28.5	0.0	26.2	-0.4	22.9	-1.0	0.3	1.2	1.2
JUN 96	29.7	0.4	28.6	0.1	25.7	-0.4	21.5	-1.2	1.4	1.6	-0.2
JUL 96	29.8	0.6	28.4	-0.1	25.1	-0.1	20.4	-1.2	0.7	0.6	-0.6
AUG 96	29.6	0.5	28.4	0.0	24.3	-0.3	20.5	-0.1	0.4	0.4	-0.3
SEP 96	29.8	0.6	28.4	0.1	24.3	-0.3	19.8	-0.5	0.5	-0.7	-1.7
OCT 96	29.9	0.6	28.5	0.1	24.3	-0.3	20.4	-0.3	0.4	-0.1	-0.8
NOV 96	29.5	0.3	28.2	-0.2	24.3	-0.3	20.5	-1.0	-0.0	-0.5	-0.5
DEC 96	29.2	0.3	28.3	0.1	24.1	-0.8	21.8	-0.8	0.8	-0.3	-1.9
JAN 97	28.6	0.1	28.3	0.3	24.7	-0.7	23.4	-0.9	0.3	1.7	0.9
FEB 97	28.5	0.2	28.2	0.2	25.9	-0.3	25.9	0.2	1.2	1.0	-1.9
MAR 97	28.3	-0.1	28.4	0.3	27.0	0.1	27.1	1.2	-0.6	-0.5	0.9
APR 97	29.0	0.2	29.1	0.9	27.5	0.4	26.3	1.2	-1.1	0.4	2.3
MAY 97	29.5	0.4	29.4	0.9	27.9	1.3	26.5	2.6	-2.5	-2.1	0.9
JUN 97	29.6	0.3	29.3	0.8	28.1	2.0	25.7	3.0	-2.3	-0.8	2.1
JUL 97	29.5	0.3	29.4	0.9	27.8	2.6	25.5	3.9	-0.8	-0.1	1.2
AUG 97	29.0	-0.1	29.2	0.8	27.7	3.1	24.0	3.4	-2.0	-0.9	2.2
SEP 97	29.0	-0.2	29.4	1.1	27.5	2.9	24.2	3.9	-1.4	0.1	2.7
OCT 97	29.6	0.3	29.1	0.7	27.9	3.3	24.8	4.1	-1.6	-0.2	2.7
NOV 97	29.5	0.3	29.3	0.9	28.2	3.6	25.4	3.9	-1.2	0.4	2.7
DEC 97	29.1	0.2	29.2	1.0	28.3	3.4	27.1	4.5	-0.9	-0.5	1.1

第1表　エルニーニョ監視指数

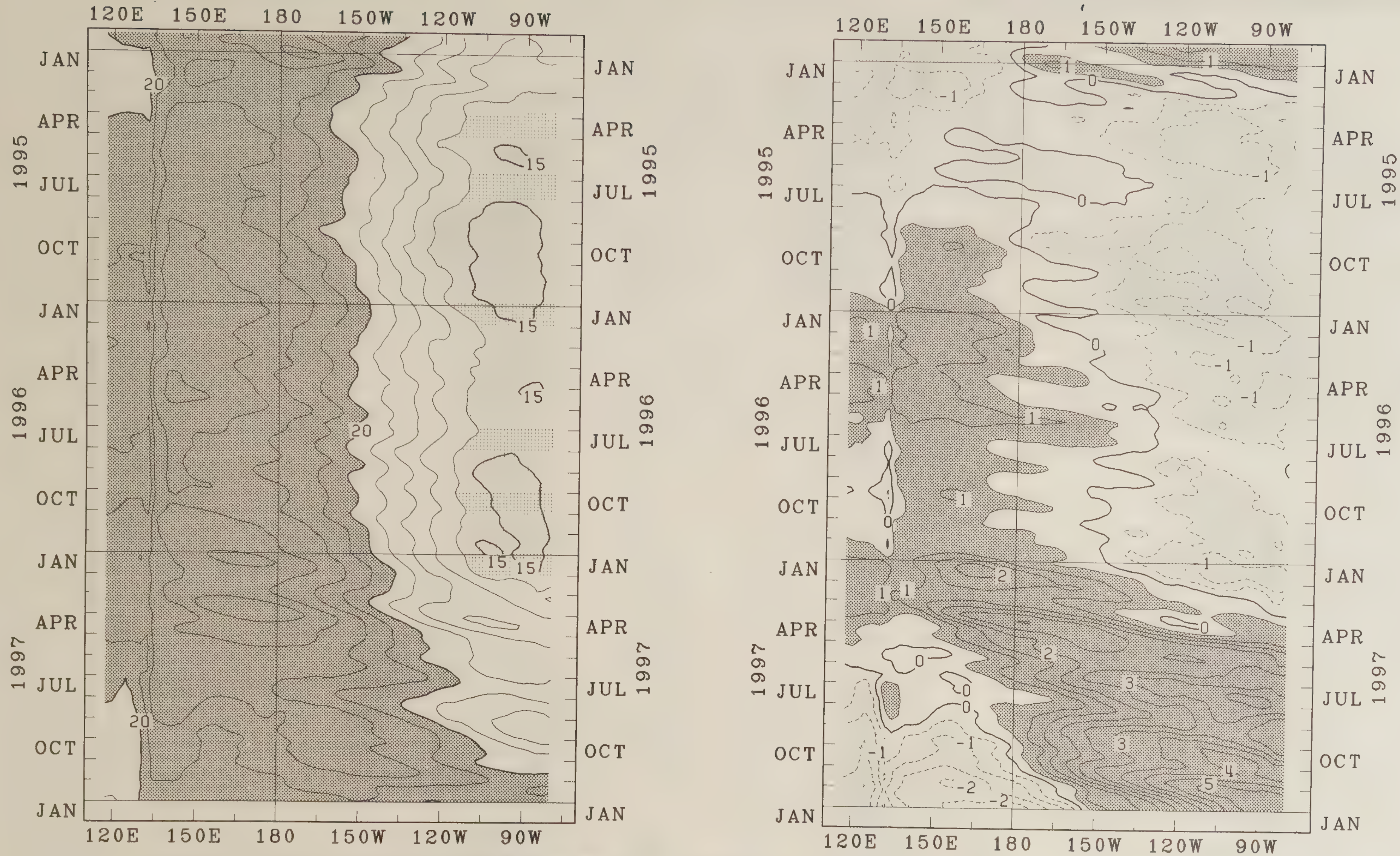
Table 1 El Nino Monitoring indices

第 25 図　赤道に沿った海面水温（左）および偏差（右）の時間-経度断面図

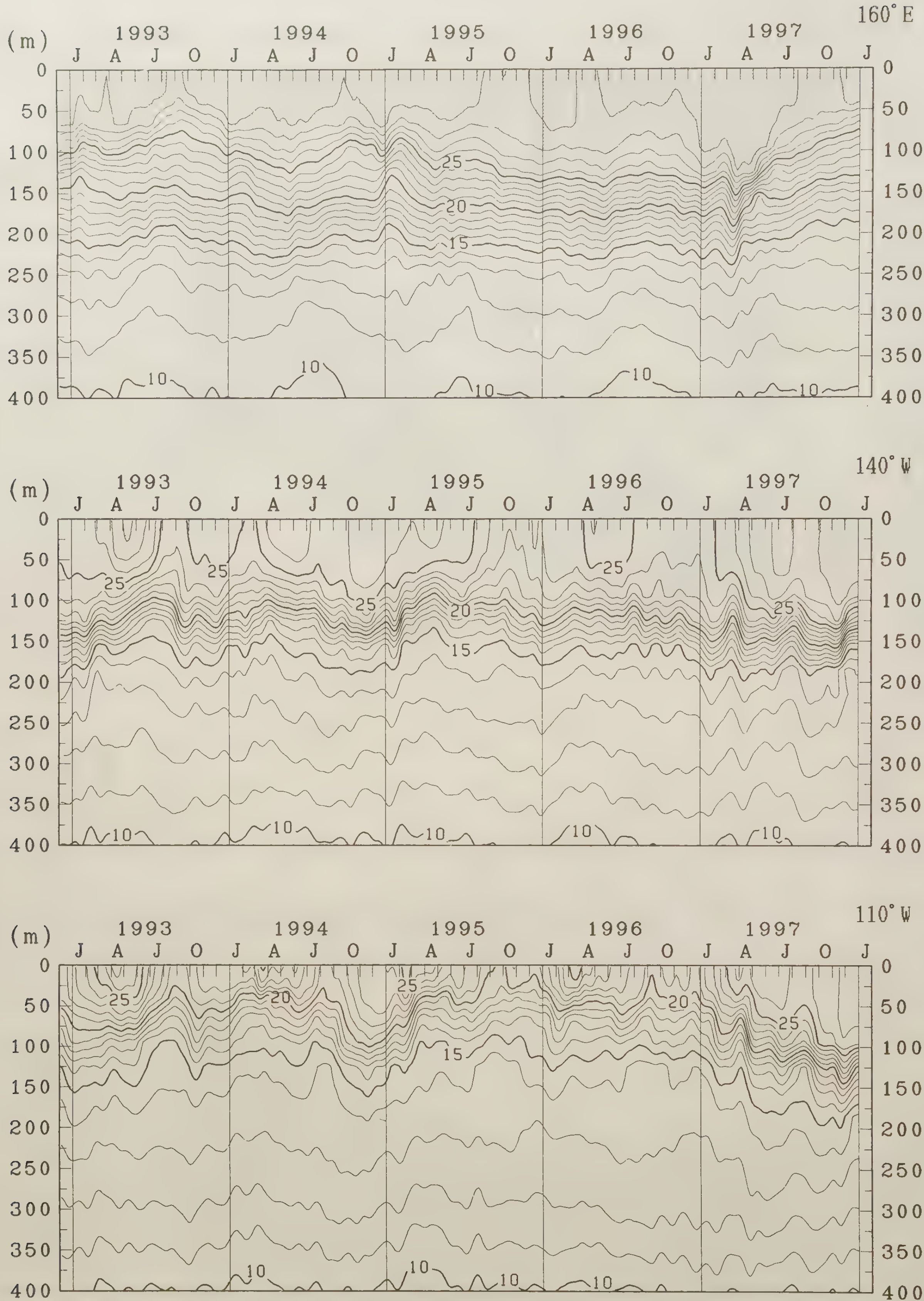
Fig.25 Time-longitude sections of SSTs (left) and anomalies (right) along the equator (2 °N-2 °S) in the global ocean. Contour interval is 1 °C (left) and 0.5 °C (right). Values greater than 28 °C are shaded and values less than 23 °C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1961-1990 base period means.

Time-Longitude Sections of Ocean Heat Content & Anomalies (Eq.)



第26図　太平洋の赤道に沿う海洋表層の貯熱量（左）及び偏差（右）の時間－経度断面図

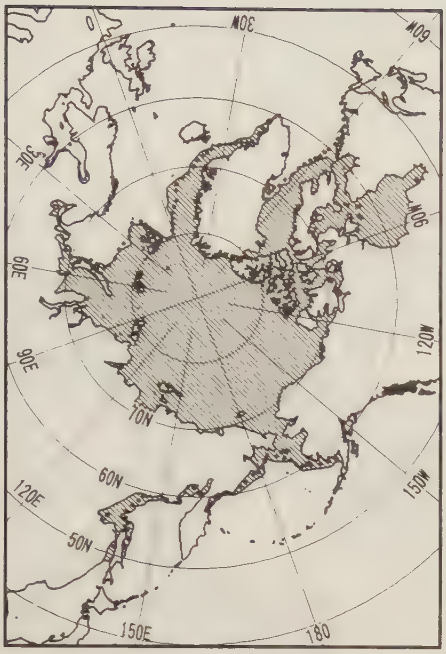
Fig.26 Time-longitude sections of ocean heat content in the upper 260m along the equator (left) and anomalies (right) in the Pacific Ocean. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (left) and 0.5°C (right). Values greater than 20°C are shaded and values less than 16°C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1987-1996 base period means.



第27図　太平洋赤道域の表層水温の時間－深度断面図

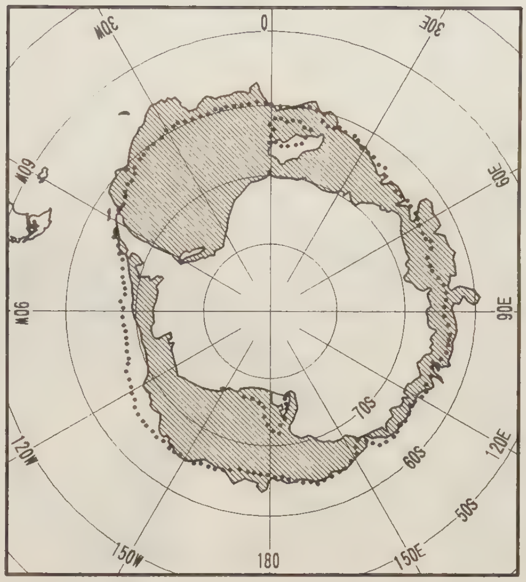
（上：西部、中：中部、下：東部）

Fig.27 Time-depth sections of equatorial subsurface temperature for the western Pacific (top, 160°E), the central Pacific (middle, 140°W) and the eastern Pacific (bottom, 110°W). Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C. Values greater than 28°C are shaded.



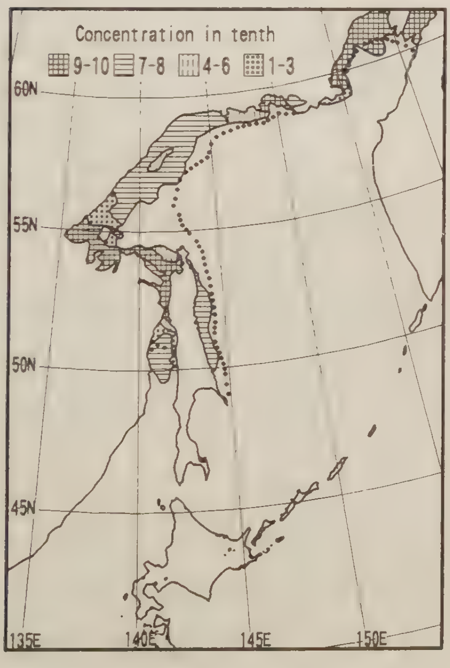
第28-1図 北極域の海氷図（1997年12月19日）

Fig.28-1 Sea ice chart in the Arctic on 19 Dec. 1997.
The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1972 through 1990.
The data source is the National Ice Center (USA).



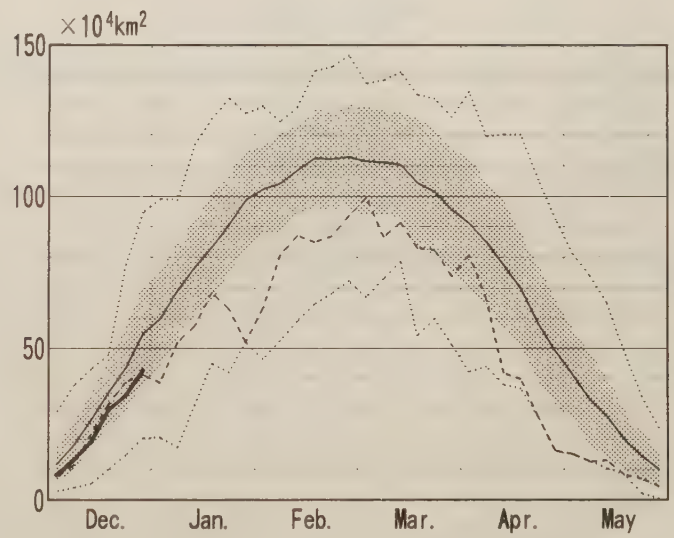
第28-2図 南極域の海氷図（1997年12月19日）

Fig.28-2 Sea ice chart in the Antarctic on 19 Dec. 1997.
The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1973 through 1990.
The data source is the National Ice Center (USA).



第28-3図 オホーツク海の海氷図（1997年12月15日）

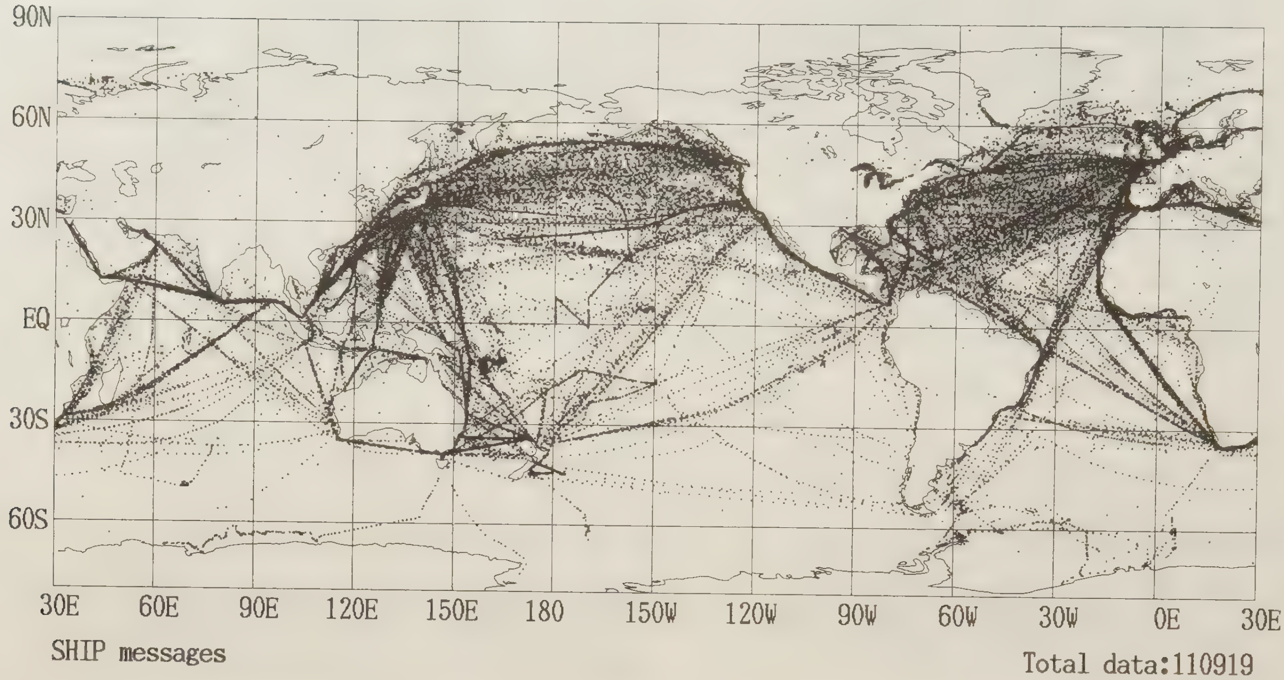
Fig.28-3 Sea ice chart in the Sea of Okhotsk on 15 Dec. 1997.
The dotted line denotes the mean ice edge averaged for the period from 1971 throuh 1990.

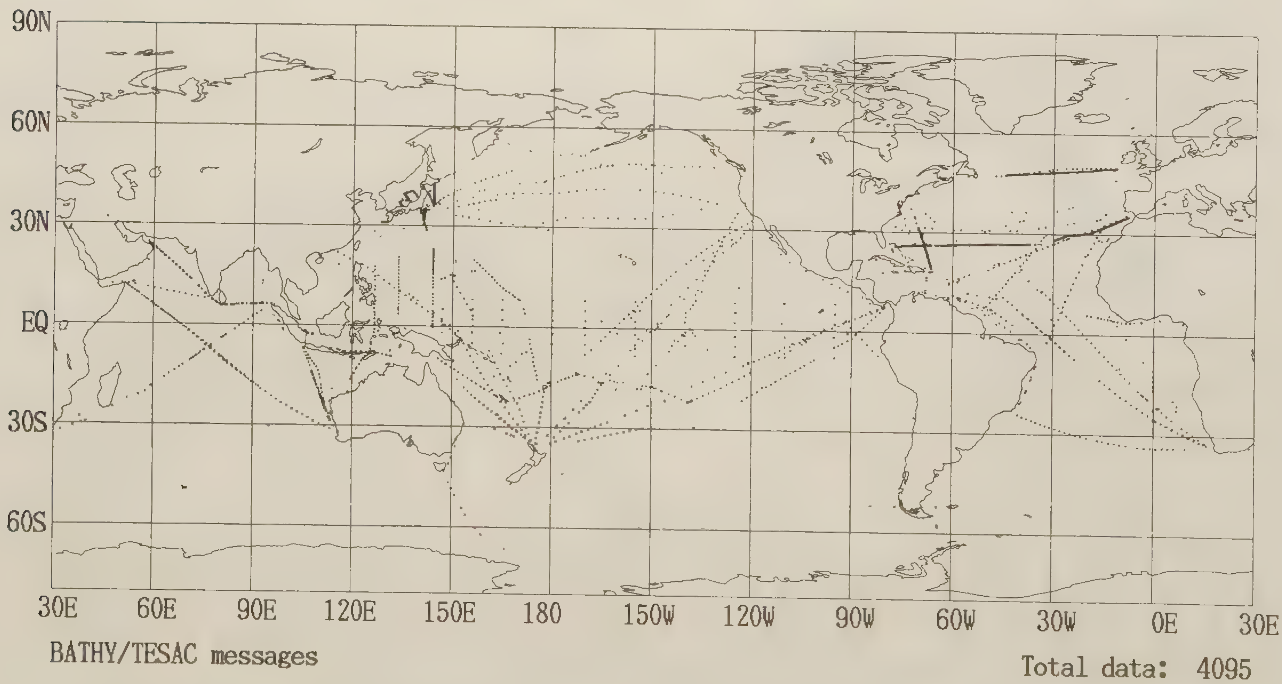


第28-4図 オホーツク海の海氷域面積

Fig.28-4 Time-series of 5-day sea ice extent in the Sea of Okhotsk.

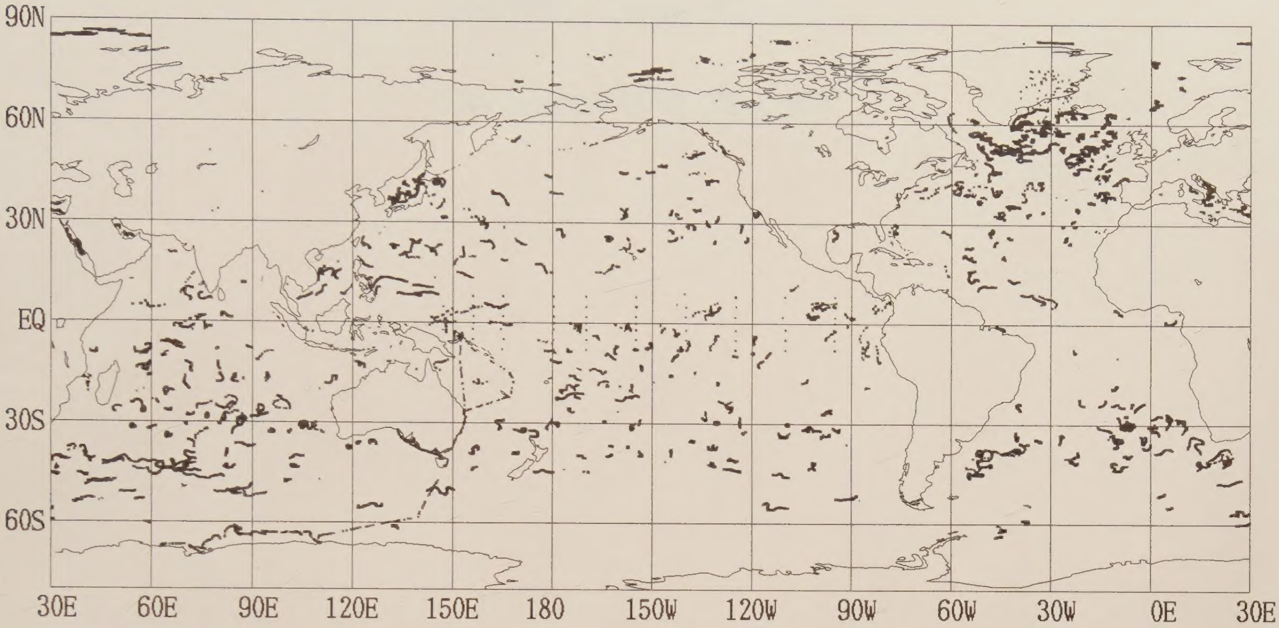
: current season(1997/98)
: mean extent(1971-1990)
: maximum or minmum extent(1971-1997)
: last season(1996/97)
: mean ± 1σ (1971-1990)



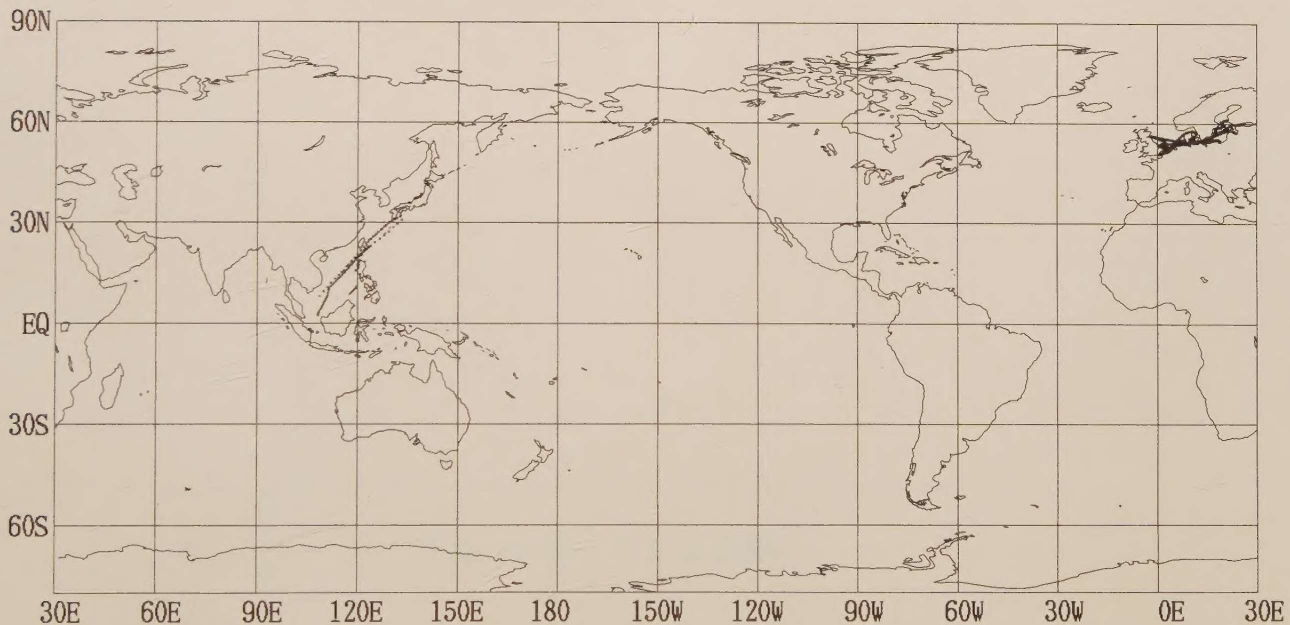


第29-1図　測点分布図(1997年12月)

Fig.29-1 Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for DEC 1997.



BUOY messages Total data:238045



TRACKOB messages Total data: 1392

第29-2図　測点分布図(1997年12月)

Fig.29-2 Geographical distribution of BUOY messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for DEC 1997.

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